9. *The Genus Eumenes, Latreille, in South Africa, with a Revision of the Ethiopian Species* (*Hymenoptera*).—By Dr. J. Bequaert, Department of Tropical Medicine, Harvard Medical School.

(With 14 Text-figures.)

The present paper is the second of the contemplated series on South African Diploptera. The genus *Eumenes* is so much better represented in South Africa than in the equatorial regions of the continent, that I have been induced to offer a revision of all Ethiopian species. I was thus enabled to correct several errors of my former work (Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 54–86), which should, however, be used in connection with the present paper, for the equatorial species.

I wish to acknowledge my indebtedness to the late Dr. L. Péringuey, former Director of the South African Museum, for the loan of much material. I am under especial obligation to Dr. H. Brauns, of Willowmore, who very kindly entrusted me with the valuable types of some species described by A. v. Schulthess. A few specimens were received for study from Dr. G. Arnold, Curator to the Rhodesia Museum, and some of the Katanga material was collected by my brother, Dr. Michael Bequaert. During a brief visit at the British Museum, I had occasion to examine a number of interesting specimens mentioned in the paper, and I have also included records from the collections of various other institutions. Finally, I desire to thank Dr. E. L. Gill for the editing in the Annals of the South African Museum.

For a general account of the characters and life-history of the genus, I refer to my Revision of Congo Vespidae quoted above. So far as I can see, the habits of none of the peculiarly South African species have been studied thus far, so that a wide field of discovery here awaits some enterprising South African entomologist.

Many of the South African species appear to be quite local or very rare, and additional forms will certainly still come to light, while others are thus far known in one sex only. The entomologist who wishes to understand specific limits in *Eumenes* should learn to disregard the colour pattern, which not only is often extremely variable,

but, in addition, is frequently almost identical in species that are morphologically quite distinct. In closely allied forms, the shape of the first abdominal segment and especially of the terminal hook of the male antenna appear to afford the most reliable characters. Since the differences are rather difficult to describe, the outline drawings may prove of some help. Descriptions of supposedly new species, based on colour markings alone, are practically worthless, as it is impossible to recognise them without having access to the types.

The generic distinction between *Eumenes* and *Pachymenes*, although purely arbitrary, fortunately entails no great difficulty so far as the Ethiopian fauna is concerned. In *Pachymenes*, the first tergite of the abdomen is short and funnel-shaped, as a rule shorter than the second; in *Eumenes* it forms a slender petiole, which is at least as long as the second tergite. The Ethiopian *Pachymenes* are all of small size, at most 10 mm. in total length. In size and general appearance *Pareumenes* approaches *Eumenes* rather closely, but the first tergite is moderately long and triangular in outline, seen from above; in profile it is abruptly sloping just before the base, where it presents a blunt ridge or crest, often followed by a slight constriction. Of the two African species (one of which is as yet undescribed), one shows a sharp and long spine on each side of the propodeum, above the valvulae, which, however, is totally absent in the other. These propodeal spines are not found in any *Eumenes*, and have sometimes been regarded as a generic character of *Pareumenes*, but they are absent in several of the Indian species of *Pareumenes* too. Formerly, when the genus was known to me from descriptions only, I had placed *Pareumenes* among the Zethinae. I have since had occasion to examine several species, and find that in all of them the mandibles are distinctly decussate and knife-shaped, as in the Eumeninae. In some they are hardly different from those of *Eumenes*, while in others they are much broadened and probably adapted to nesting in wood. The two types of mandibles are represented by the two African species.

I have followed J. Sichel[1] in regarding *Eumenes* as of masculine gender. The use of *Omicron* and *Delta* as subgeneric names will probably be questioned by entomologists who study linguistics rather than insects. Since, however, similar Greek letters have been commonly accepted as specific names, while some of them are used as generic names in other groups, I fail to see why they should be rejected in the Vespidae.

[1] "Note sur le sexe des noms génériques *Polistes*, *Eumenes* et des autres noms génériques terminés en *es*," Ann. Soc. Ent. France, (4) iii, 1863, pp. 20–22.

Subdivisions of Eumenes.

After eliminating *Pachymenes* and *Pareumenes*, *Eumenes* still contains over 200 described species, many of which differ greatly in shape. If the fauna of a limited area be considered, they are rather easily arranged in natural groups, but whether these are of sufficient value to be regarded as valid subgenera is a troublesome question. Since, however, some have been named, I shall provisionally give them subgeneric rank. As I wish to introduce new names for three of the groups, a brief review of the nomenclature is appended.

1. Eumenes, Latreille, Hist. Nat. Crust. Ins., iii, 1802, p. 360. Genotype: *Vespa coarctata*, Linnaeus, 1758, as designated by Latreille, Considér. Génér. Crust. Arachn. et Ins., 1810, p. 438; by Bingham, Fauna of British India, Hym., i, 1897, p. 333; and by Ashmead, Canad. Entomol., xxxiv, 1902, p. 207.[1]

Syn.: *Eumenes* 1ère division, H. de Saussure, Et. Fam. Vesp., i, 1852, p. 28.

Eumenes division *Alpha*, H. de Saussure, Et. Fam. Vesp., iii, 1856, p. 128. Type by present designation: *Vespa coarctata*, Linnaeus, 1758.

Eumenes subgenus *Eumenidion*, A. v. Schulthess, Societas Entomol., xxviii, 1913, p. 2. Type by original designation: *Vespa coarctata*, Linnaeus, 1758.

The subgenus *Eumenes* proper should cover the group containing the genotype, and consequently *Eumenidion* is an exact synonym of *Eumenes* proper. I can, therefore, not follow v. Schulthess where he uses "*Eumenes* s. str." for the group of *E. maxillosus* (Zool. Jahrb. Abt. Syst., xxxvii, 1914, p. 262).

Medium-sized species, with strongly convex, subglobular thorax; no epicnemial anterior carina and no longitudinal keel on the posterior part of the mesopleura. Head moderately flattened; mandibles decussate, long and straight, slightly notched along the inner margin. First abdominal segment variously shaped, often more or less campanulate; with a basal, narrow, stalk-like portion, followed by a much broader apical part. Apex of second tergite duplicate: the hind margin proper forming a thin, depressed, and smooth lamella, which is preceded by a much thickened portion; the two are separated by a deep groove, which is generally foveolate.

[1] Westwood (Introd. Modern Class. Insects, II, Synopsis, 1840, p. 83) gives as type *Vespa atricornis*, Fabricus, which is generally regarded as a probable synonym of *Vespa coarctata*, Linnaeus. Moreover, his designation had been anticipated by Latreille (1810).

This is the common type in the Palaearctic and Nearctic regions, where it is represented by several closely allied species. In the Oriental region it contains *F. punctatus*, de Saussure, and in the Ethiopian region, *E. braunsianus*, A. v. Schulthess, *E. lucasius*, de Saussure, *E. acuminatus*, de Saussure, *E. capensis*, A. v. Schulthess, *E. fülleborniánus*, A. v. Schulthess, *E. peringeyanus*, A. v. Schulthess, *E. langi*, J. Bequaert, *E. arnoldi*, J. Bequaert, *E. oculihirtus*, J. Bequaert, and *E. pomiformis* (Rossi).

The following groups are in my opinion not sufficiently distinct from *Eumenes* proper to warrant their use in a subgeneric sense :—

Eumenes division *Beta*, H. de Saussure, Synopsis of American Wasps, 1875, p. 88. Type by present designation : *Eumenes nortonianus*, de Saussure, 1875.

Eumenes division *Gamma*, Zavattari, Arch. f. Naturgesch., lxxviii, Abt. A, Heft 4, 1912, p. 85. To cover " *Pachymenes* II^{e} division " of de Saussure, Et. Fam. Vesp., i, 1852, p. 77. Type by present designation : *Pachymenes ventricosa*, de Saussure, 1852.

2. Subgenus Omicron, H. de Saussure. Type by present designation : *Zethus globicollis*, Spinola, 1841.

Syn. : *Eumenes* VI^{e} division, H. de Saussure, Et. Fam. Vesp., i, 1852, p. 71.

Eumenes division *Omicron*, H. de Saussure, Et. Fam. Vesp., iii, 1856, p. 133.

Small species, with extremely globular and convex thorax. Mesopleura anteriorly with a distinct epicnemial carina, which continues on the sternum in front of the middle coxae ; without vertical keel posteriorly. Head much flattened ; mandibles relatively short, decussate, slightly curved at apex and strongly toothed within. First abdominal segment long and strongly campanulate : the basal, stalk-like portion quite slender and suddenly widened into the apical, bell-shaped part. Apex of second tergite duplicate, as in *Eumenes* proper.

Although in the shape of head, thorax, and first abdominal segment there are transitional forms to *Eumenes* proper, I retain this group as a subgenus on the strength of the presence of an epicnemial carina on the mesopleura. So far as known to me, this subgenus is exclusively Neotropical.

3. Subgenus Afreumenes, J. Bequaert. Monotypic for *Eumenes melanosoma*, H. de Saussure, 1852.

Medium-sized, with moderately convex and subglobular thorax. Mesopleura anteriorly with an epicnemial suture continuing on the

sternum in front of the middle coxae ; and posteriorly with a sharp laminate keel forming an epicnemial area for the middle legs. Head flattened ; mandibles long, straight, parallel, beak-like, slightly notched along the inner margin. First abdominal segment long and slender, gradually widened from base to apex, longitudinally grooved above. Apex of second tergite simple.

This subgenus is exclusively Ethiopian.

4. Subgenus Delta, H. de Saussure. Type by present designation : *Vespa maxillosa*, de Geer, 1775.

Syn. : *Eumenes* II^{e} division, H. de Saussure, Et. Fam. Vesp., i, 1852, p. 44 ; and III^{e} division, *op. cit.*, p. 60.

Eumenes division *Delta*, H. de Saussure, Et. Fam. Vesp., iii, 1856, p. 130.

Medium-sized to large species, with moderately convex, ovate or lengthened thorax ; mesopleura with or without anterior epicnemial carina, but without posterior keel. Head moderately flattened ; mandibles long, straight, parallel, beak-like, slightly notched along the inner margin. First abdominal segment long and slender, stalk-like, but always wider at apex than at base. Apex of second tergite simple or slightly thickened before the margin.

This subgenus is almost cosmopolitan in distribution, but apparently does not occur in the Nearctic region. The following Ethiopian species belong to it : *F. maxillosu s*(de Geer), *E. caffer* (Linnaeus), *E. campaniformis* (Fabricius), *E. phthisicus*, Gerstaecker, *E. lepeleterii*, H. de Saussure, *E. alluaudi*, J. Pérez, and *E. macrocephala*, H. de Saussure.

The following two groups are connected with the subgenus *Delta* by so many transitional forms that it appears impractical to accord them subgeneric rank :—

Eumenes division *Phi*, H. de Saussure, Et. Fam. Vesp., iii, 1856, p. 132. To cover *Eumenes* IV^{e} division of de Saussure, Et. Fam. Vesp., i, 1852, p. 63. Type by present designation : *Vespa arcuata*, Fabricius, 1775.

Eumenes division *Zeta*, H. de Saussure, Et. Fam. Vesp., iii, 1856, p. 132. To cover *Eumenes* V^{e} division of de Saussure, Et. Fam. Vesp., i, 1852, p. 67. Type by present designation : *Sphex abdominalis*, Drury, 1770.

5. Subgenus Zetheumenidion, J. Bequaert. Type : *Eumenes femoratus*, A. v. Schulthess, 1910.

Medium-sized, with ovate, broad, and moderately convex or flattened thorax ; mesopleura without anterior epicnemial suture or posterior

carina ; anterior margin of pronotum with a lamellate crest. Head but slightly flattened ; mandibles short, decussate, strongly ribbed on the outer face, with four sharp teeth along the inner margin. Vertex with hairy fovea in female. First abdominal segment very slender and ribbon-shaped. Apex of second tergite duplicate, the terminal lamella often raised and collar-like. Hind femora of male swollen ; middle and hind tibiae of female with spinose setae.

This peculiar group consists of two Ethiopian species. It strongly suggests the Zethinae in general appearance, but the mandibles are still as in *Eumenes*. The venation of the wing is as in the Eumeninae, the second cubital cell being lozenge-shaped and its lower or cubital margin being but slightly deflected where it receives the first recurrent nervure. In the Zethinae the first section of the lower margin of the second cubital cell is usually placed vertically upon the first recurrent nervure, which runs almost in a straight line with the remainder of the cubitus.

On account of the rather short mandibles, *Ischnogasteroides*, Magretti (Bull. Soc. Ent. Italiana, xv (1883), 1884, p. 251 ; Ann. Mus. Civ. Genova, xxi, 1884, p. 603), appears to be related to *Zetheumenidion*, and I have little doubt that it, too, represents a group of Eumeninae, perhaps not really distinct from *Eumenes*. The only species, *Ischnogasteroides flavus*, Magretti, of Abyssinia, has apparently not been found again. It is, however, quite possibly identical with *Eumenes leptogaster*, F. Walker (List of Hymenoptera collected by J. K. Lord in Egypt, 1871, p. 30), of which I have seen the type (♂) and two other males, from Wady Ferran (=Wady Faran in the Peninsula of Sinai), in the British Museum. It is about the size of *E. femoratus*, but extremely slender ; not only is the first abdominal segment very long and thin, but the second is narrowed at the base into a long neck, as in *Paramischocyttarus*. Yet the shape of the mandibles leaves no doubt as to its being a *Eumenes*. It will undoubtedly form a distinct subgenus, for which Magretti's name *Ischnogasteroides* will perhaps be available. For this reason I refrain from proposing a new term.

6. Subgenus Oreumenes, J. Bequaert. Monotypic for *Eumenes harmandi*, J. Pérez, 1905.

Medium-sized species ; mesopleura without anterior epicnemial suture or posterior carina. Mandibles of the usual *Eumenes* type. Vertex without hairy fovea in female. Antennae 12-segmented in female ; 13-segmented in male, the last segment short, of normal shape, not forming a recurved hook. Hind margin of second abdominal tergite slightly duplicate.

The unusual shape of the male antennae, which I have observed in several specimens of *E. harmandi*, from Japan and China, was noted by Pérez in his original description.

Key to Ethiopian Species of Eumenes.

1. ♀♂. Mesopleura with epicnemial carinae anteriorly, and, in addition, posteriorly with a lamellate keel bordering epicnemia for the middle legs. First abdominal segment quite slender, longer than the thorax, distinctly curved in profile; with a shallow, longitudinal groove on its dorsal, flattened face; the groove more distinct apically. Second tergite moderately swollen, with slightly depressed, simple, impunctate hind margin. Clypeus not emarginate, subtruncate at apex, with the edges broadly rounded off. Antennae slender; all the segments longer than broad; terminal hook of male moderately long, unguiculate, rather suddenly narrowed before the middle into a sharp apex. Length (h.+th.+t. 1+2): ♀, 13–19 mm.; ♂, 9·5–15 mm.

E. melanosoma, H. de Saussure (p. 526)

Mesopleura without raised keel in their posterior half; the epicnemial depression for the middle legs not margined 2

2. Apex of second tergite duplicate: the smooth, flattened or raised marginal lamella separated by a foveolate groove from a preapical thickened area 3

Apex of second tergite simple: the depressed margin impunctate, but not divided from the preapical punctate area by a groove 12

3. Anterior margin of pronotum with a collar-like, raised, translucent lamella. Mandibles short and stout, decussate, strongly ribbed and deeply grooved on the outer surface, with four stout teeth along the inner margin. Vertex long, with a hairy fovea in the female. Legs stout; hind femora of male conspicuously swollen, their lower, posterior face bearing a short spine; middle and hind tibiae of female with rows of short, stiff setae. Apical lamella of second tergite often more or less collar-like, preceded by a deep groove, which bears many longitudinal short ribs 4

Anterior margin of pronotum either rounded off or with a low, linear carina, not with a translucent lamella. Mandibles generally more slender, but superficially grooved on the outer surface. Vertex without hairy fovea in female. Legs slender, the femora not thickened and without spine in the male; the tibiae of the female without stiff setae. Apical lamella of second tergite flattened 5

4. ♀♂. Thorax coarsely and uniformly punctate, distinctly convex dorsally, not appreciably depressed, in profile about one and one-half times as long as high; the scutellum and postscutellum distinctly sloping and the short propodeum much below the level of the mesonotum. First abdominal segment flattened dorsally. Clypeus of female truncate at apex. Hind femora of male much swollen, the tooth of the hind face placed in a deep, oblique groove. Length (h.+th.+t. 1+2): ♀, 14–15 mm.; ♂, 12·5 mm.

E. femoratus, A. v. Schulthess (p. 493)

♀♂. Thorax less coarsely punctured, more shiny, much depressed and but little convex above, in profile about two and one-half times as long as high; the scutellum and postscutellum part of the dorsal face of the thorax; the

propodeum quite long, its anterior, slightly sloping portion but little below the level of the mesonotum. First abdominal segment not flattened dorsally. Clypeus of female shallowly emarginate at apex. Hind femora of male moderately swollen, the spine of the hind face not placed in an oblique groove. Length (h.+th.+t. 1+2): ♀, 16-16·5 mm.; ♂, 12·5 mm.

E. paeneplanus, J. Bequaert (p. 498)

5. ♀♂. Second abdominal segment much swollen, bell-shaped and somewhat compressed, about as high as long in profile; the tergite pinched before the preapical swelling, being slightly raised in the middle with a shallow depression on each side. First segment about three and one-half times as long as wide, nearly parallel-sided in the apical half and with a trace of longitudinal groove above; the basal third much narrower. Clypeus nearly impunctate, the apical margin slightly sinuate in female, nearly straight in male. Length (h.+th.+t. 1+2): ♀, 13·5-14·5 mm.; ♂, 13 mm.

E. braunsianus, A. v. Schulthess (p. 502)

Second tergite not pinched on the middle before the preapical swelling, either normally convex or with a transverse depression 6

6. ♀♂. Second abdominal segment much swollen dorsally, bell-shaped and distinctly compressed; about as high as long in profile and distinctly higher than wide; the tergite with a shallow, transverse depression before the preapical swelling. First segment very long and slender, about as long as head and thorax, four and one-half to five times as long as wide, quite gradually widening from the base to the middle, not grooved above except before the apex. Clypeus deeply emarginate at apex in both sexes. Eyes bare. Length (h.+th.+t. 1+2): ♀, 12–13·5 mm.; ♂, 11 mm.

E. peringeyanus, A. v. Schulthess (p. 505)

Second abdominal segment much less swollen and but slightly or not compressed, generally as long as or longer than high in profile. In doubtful cases the first segment has a different shape, or the clypeus is not deeply emarginate at apex, or the eyes are pubescent 7

7. ♀♂. Small species. Second abdominal segment swollen and bell-shaped, but not compressed, with strongly duplicate hind margin; the posterior half of the tergite coarsely punctate (abnormally wrinkled in the type specimen of the var. *langi*). First segment about as long as head and thorax; the apical two-thirds ribbon-shaped, parallel-sided, flattened above; gradually narrowed into the basal third. Clypeus broadly emarginate at apex in both sexes. Black, with very few yellowish-white markings, and occasionally partly ferruginous; clypeus black in both sexes. Length (h.+th.+t. 1+2): ♀, 8–11·5 mm.; ♂, 7–9 mm. . *E. fülleborniánus*, A. v. Schulthess (p. 509)

Larger species, with differently shaped first and second abdominal segments 8

8. ♀♂. Eyes densely covered with long pubescence. Anterior margin of pronotum with a fine raised line, which is completely effaced in the middle. First abdominal segment very slender, about as long as head and thorax, flattened above and slightly grooved toward apex, sparsely and finely punctate. Length (h.+th.+t. 1+2): ♀, 13–14 mm.; ♂, 12–13 mm.

E. oculihirtus, J. Bequaert (p. 511)

Eyes bare 9

9. ♀♂. Anterior margin of pronotum blunt, with a mere trace of raised line, broadly rounded off at the sides. First abdominal segment moderately

long, about as long as the thorax; the basal stalk very gradually widened into the apical half, which is parallel-sided, somewhat flattened and slightly grooved above. Head and thorax densely hairy; rather coarsely punctate, densest on the mesonotum, not subreticulate on the mesopleura; punctures of first segment large, but scattered; of the second tergite finer, but very dense, uniformly covering the whole surface. Length (h.+th.+t. 1+2): ♀, 11–12 mm.; ♂, 9–11 mm. . . *E. lucasius*, H. de Saussure (p. 514)

Anterior margin of pronotum rimmed throughout with a raised line which, although low, is quite distinct; humeral angles obtuse. First abdominal segment of different shape 10

10. ♀♂. First abdominal segment campanulate, about as long as the thorax; not three times as long as its greatest width; with a short stalk; the apical two-thirds much widened and swollen, coarsely punctured all over and with shallow longitudinal groove. Vertex and temples long. Median part of propodeum broadly and very shallowly concave. Black, with bright yellow markings only; the second tergite with apical fascia and two lateral, oblique spots near the middle. Length (h.+th.+t. 1+2): ♀, 10·5–12 mm.; ♂, 9–11 mm. . . . . *E. pomiformis* (Rossi) (p. 501)

First abdominal segment not campanulate, much more slender. Vertex and temples short. Median part of propodeum distinctly grooved in its lower half. Mostly black and ferruginous, with few pale yellow markings; no yellow spots near middle of second tergite 11

11. ♀♂. First abdominal segment moderately slender, less than four times as long as wide at apex, nearly as long as the thorax; the basal, stalk-like third rather abruptly widened into the parallel-sided apical portion, which is flattened and distinctly grooved dorsally. Head and thorax densely hairy, closely and coarsely punctate; the mesopleura subreticulate. Antennae distinctly thickened: the fifth segment (in female) but slightly longer than wide, the sixth nearly square. Length (h.+th.+t. 1+2): ♀, 12 mm.; ♂, 10·5 mm. . . . *E. acuminatus*, H. de Saussure (p. 520)

♀. First abdominal segment long and slender, about five times as long as wide at apex, much longer than the thorax; gradually widening from base to apex; the apical portion not parallel-sided, slightly flattened above and grooved toward the apex only. Thorax but slightly pilose; its puncturation moderately coarse and dense, the mesopleura not subreticulate; a row of fine, longitudinal rugosities at base of postscutellum. Antennae moderately thickened: the fifth segment distinctly and the sixth slightly longer than wide. Length (h.+th.+t. 1+2): 12 mm. Male unknown.

E. arnoldi, J. Bequaert (p. 517)

12. ♂. Head swollen; vertex and temples well developed, the posterior ocelli nearly as far from the hind margin of the vertex as from each other. Apical margin of clypeus straightly truncate. Legs stout; the middle basitarsus broad, forming a flattened prism. First abdominal segment elongate campanulate, about three times as long as its greatest width, longitudinally grooved in its apical half. Antennal hook large, narrowly spatulate, pointed at apex, with a blunt dorsal ridge. Length (h.+th.+t. 1+2): 14 mm. Female unknown . . . *E. macrocephala*, H. de Saussure (p. 568)

Head not swollen; vertex and temples short (except in *alluaudi*). Legs slender; the middle basitarsus of male not broadened. First abdominal

segment not longitudinally grooved. Antennal hook of male of different shape 13

13. ♀♂. First abdominal segment quite long and slender, about as long as head and thorax and nearly five times as long as wide at apex; very gradually widened from base to near apex, strongly curved in profile; the spiracles hardly protuberant. Second segment with a long basal neck. Abdomen almost impunctate. Antennal hook of male shaped like a duck's head, swollen in basal half, suddenly narrowed, with blunt apex. Length (h.+th.+t. 1+2): ♀, 15–16 mm.; ♂, 13·5–15·5 mm.

E. phthisicus, Gerstaecker (p. 531)

First abdominal segment shorter, less than five times as long as wide; always much broader at apex than at base and generally with protuberant spiracles. Basal neck of second segment short 14

14. Thorax distinctly longer than wide or high. First abdominal segment about as long as, or even slightly shorter than, the thorax; more or less abruptly widened near the middle 15

Thorax but little longer than wide or high. First abdominal segment longer than the thorax 17

15. Female: Clypeus elongate pear-shaped; the apical, free portion lengthened, slightly longer than the basal, interocular part, straightly truncate at apex; posterior ocelli about as far apart as from the inner orbits. Male: Clypeus much longer than wide, produced below into a rectangular plate which is somewhat widened at apex; inner margin of mandibles raised into a fold near base. Length (h.+th.+t. 1+2): ♀, 14–18 mm.; ♂, 17–21 mm.

E. alluaudi, J. Pérez (p. 567)

Clypeus shorter, elongate hexagonal; the apical, free portion slightly shorter than the basal, interocular part and not produced into a rectangular plate in the male. Posterior ocelli nearer to the inner orbits than to each other 16

16. ♀♂. Second abdominal sternite uniformly convex, slightly flattened at base. Posterior ocelli of female about as far from the hind margin of the vertex as from the inner orbits. Antennae of female relatively swollen; segments 7 and 8 nearly square and 9 to 11 wider than long. Antennal hook of male gradually tapering from a triangular base to a sharp, straight apex. Length (h.+th.+t. 1+2): ♀, 19–20 mm.; ♂, 13–18 mm.

E. caffer (Linnaeus) (p. 535)

♀♂. Second abdominal sternite more or less flattened or depressed in the middle, often deeply saddle-shaped. Posterior ocelli in both sexes nearer to the inner orbits than to the hind margin of the vertex. Antennae of female more slender: segments 7 and 8 slightly longer than wide, 9 and 10 almost square, 11 slightly wider than long. Antennal hook of male long and thick, curved beyond the base and swollen in its terminal half, ending in a sharp, curved apex. Length (h.+th.+t. 1+2): ♀, 17–30 mm.; ♂, 12–23 mm. . . . . *E. maxillosus* (de Geer) (p. 559)

17. ♀♂. First abdominal segment seen from above quite gradually widening from base to apex. Antennal hook of male long and slender, gradually tapering from a triangular base to a sharp apex, which is slightly curved and rests in a small pit at the under side of the tenth antennal segment. Length (h.+th.+t. 1+2): ♀, 17–19 mm.; ♂, 12–16 mm.

E. lepeleterii, H. de Saussure (p. 553)

♀♂. First abdominal segment seen from above rather suddenly widened about midway; both the basal, stalk-like and the apical, wider portion nearly parallel-sided. Antennal hook of male long, but thicker, slightly narrowed beyond the base, the apical half somewhat widened and rather rapidly tapering to the sharp, curved apex, which rests in an excavation at the under side of the tenth antennal segment. Length (h.+th.+t. 1+2): ♀, 12–18·5 mm.; ♂, 12–16·5 mm. . *E. campaniformis* (Fabricus) (p. 538)

E. capensis, A. v. Schulthess, *E. higletti*, Meade Weldo, and *E. signicornis*, F. Walker, which are not known to me, have not been included in the foregoing key.

The following species should be eliminated from the list of Ethiopian *Eumenes* :—

Eumenes bisignatus, F. Walker, 1871, described from "Wady Ferran," which is in the Sinai Peninsula.

Eumenes dilectula, F. Walker, 1871, described from "Wady Genneh," probably in the Sinai Peninsula or in Lower Egypt.

Eumenes dyscherus, E. de Saussure. As explained below, this is a South American wasp.

Eumenes elegans, H. de Saussure. This was described from Arabia and the East Indies; it is discussed in the sequel in connection with *E. esuriens* var. *gracilis*, H. de Saussure.

Eumenes leptogaster, F. Walker, 1871, described from "Wady Ferran," which is in the Sinai Peninsula.

Eumenes maculinoda, P. Cameron, 1910 (♂). Owing to the small size (total length, 7 mm.) and the short first abdominal segment, this is probably a *Pachymenes* or *Labus*.

Eumenes ornativentris, P. Cameron, 1910 (♀). This may be the female of *maculinoda*, and is likewise either a *Pachymenes* or a *Labus*.

Eumenes rufolineata, P. Cameron, 1905. This is also, in my opinion, either *Pachymenes* or *Labus*.

Subgenus Zetheumenidion, J. Bequaert.

Eumenes femoratus, A. v. Schulthess.

(Text-figure 1.)

Eumenes femoratus, A. v. Schulthess, Soc. Entomol., xxv, 1910, p. 18 (♀♂). J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, p. 276.

Eumenes pulchripennis, P. Cameron, Ann. Transvaal Mus., ii, pt. 3, 1910, pp. 158 and 160 (♀).

Female.—Head seen in front about as broad as high. Clypeus nearly as wide as long, almost hexagonal in outline, strongly convex

in its posterior half and rather suddenly sloping to the flattened anterior third; the anterior, free portion as long as the basal, interocular part; the apical margin nearly squarely truncate, with bluntly rectangular edges, measuring about one-third of the total width of the clypeus. Vertex with a small, hairy, transverse fovea a short distance from the hind margin. Vertex and temples longer than usual, margined behind with a sharp, continuous rim; the posterior ocelli somewhat nearer to the inner orbits than to the hind margin of the vertex. Ocelli placed in a slightly flattened triangle, the posterior ones a trifle closer to each other than to the inner orbits, the anterior one larger. Front unusually wide between the antennae, with a very slight median swelling in which terminates a short, upper furrow. Eyes bare, but little farther apart on the vertex than at the clypeus. Mandibles moderately long and rather wide, though still knife-shaped as in other *Eumenes*; straight, with distinctly curved apex, and four strong, triangular teeth along the inner margin; their outer surface with two wide grooves separated by a median, duplicate rib; similar ribs run a short distance from the inner and outer margin; in the groove along the outer margin there is a regular row of rather long, stiff, pale setae, directed downward. Maxillary palpi 6-segmented, labial palpi 4-segmented; the several segments shorter and thicker than usual; the last segment of the labial palpi less than half the length of the preceding. Antennae rather short and stout, the flagellum almost uniformly thickened; segments 6 and 7 nearly square, 8 to 11 slightly wider than long, 12 a little longer than wide at base. Thorax elongate oval, about one and one-half times as long as high seen in profile; a little less than one and one-half times as long as wide seen from above. Pronotum squarely truncate anteriorly; the margin with a strongly raised crest, forming a translucent, somewhat collar-shaped lamella; the humeral angles obtuse and but little prominent, the pronotum being much narrower at the anterior margin than before the base of the wings. Mesonotum slightly convex, about as long as wide, with a median, longitudinal line in its anterior half. Scutellum and postscutellum flattened and gently rounded off, being in the posterior slope of the thorax; the scutellum with a fine, median, impressed line. Propodeum short and moderately convex, its upper portion sloping, its lower portion nearly vertical; divided by a linear furrow in its upper half, somewhat more broadly but quite shallowly grooved posteriorly; its sides quite evenly rounded off. Mesopleura without carinae along the epicnemial depressions for the fore and middle legs; these depressions unusually

well marked. Legs short and stout; outer surface of middle and hind tibiae with several irregular rows of stout, stiff, pale-coloured setae, and their apex on the outer side with a dense comb of pale spines. Middle tibiae with one spur. Claws with an inner tooth shortly before the apex. Wings short and wide; the radial cell shorter and higher than usual in *Eumenes* and the second cubital cell

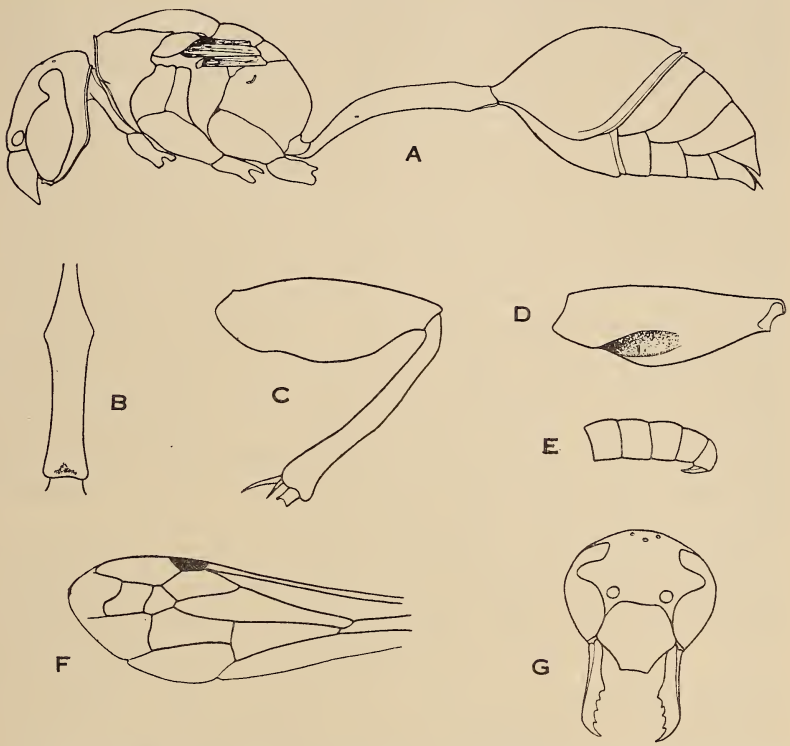

Fig. 1.—*Eumenes femoratus*, A. v. Schulthess. *A*, female in profile; *B*, first tergite of female from above; *C*, anterior view of hind femur and tibia of male; *D*, hind femur of male from below; *E*, terminal segments of male antenna; *F*, fore wing of male; *G*, anterior view of head of female.

more triangular in outline, with shorter radial margin; the third cubital cell about as long as the second along the cubitus; the basal vein ends in the subcosta quite close to the stigma (in most other *Eumenes* considerably before). First abdominal segment long and slender, about as long as the thorax, about seven times as long as its greatest width seen from above; in profile but little and quite gently curved, uniformly thick throughout, except near the base; dorsally it is distinctly flattened and more or less ribbon-shaped, though

widened at the apex and somewhat more so in the basal third, where the spiracles form well-marked protuberances on the sides; there is a distinct longitudinal groove over the basal half. Second segment with a short but distinct basal neck, regularly campanulate, the tergite but little more convex than the sternite, distinctly longer than high in profile and slightly longer than wide from above, not in the least compressed; the hind margin of sternite and tergite conspicuously duplicate; the apical lamella translucent, smooth, somewhat upturned and more or less collar-like; the preapical swelling quite conspicuous, followed by a deep, transverse channel with a series of short ribs; base of second sternite flattened, but not depressed. Puncturation coarse and dense on the thorax, somewhat finer but still more dense on the head; the clypeus very coarsely punctate; tegulae with a number of deep and large punctures and a small, smooth area near the outer margin. The hind corners of the mesonotum have a short smooth space on each side above the tegulae, connected with the smooth post-tegulae. First tergite with minute, scattering punctures, which are much larger and deeper on the anterior half in the middle. Second segment almost impunctate, except before the preapical swelling, where there are a series of very large and deep punctures, more abundant in the middle than on the sides. Succeeding segments impunctate. Pubescence very sparse, except on the head and propodeum, where it is greyish-white.

Black, abundantly marked with ferruginous red as follows: clypeus (somewhat orange), mandibles (with more brownish apex and teeth), antennae (the four apical segments brownish above), a spot at the bottom of ocular sinus, an elongate spot in the upper part of the temples, pronotum (the extreme lower edges black), tegulae, the upper plate of the mesopleura, scutellum, postscutellum, propodeum (except for black margins and median line), legs, sides and apex of first segment quite broadly, second sternite (except for a wide, longitudinal, black band not reaching the apex), second tergite (except for a broad, median, triangular black spot, which is drawn out into a point in the middle toward the basal neck), and ill-defined apical bands on some of the succeeding segments. Often the black is more extensive, the pronotum, scutellum, and upper plate of the mesopleura being blotched with that colour; the basal neck of the second segment may be entirely black and connected by a wide band with the black area of the second tergite. At the apex of the first and second tergites the ferruginous sometimes shades into orange. Hind tibiae rather broadly yellowish along the outer surface. Wings decidedly smoky

throughout, somewhat darker anteriorly, with beautiful purplish and golden reflections, the costa amber-coloured ; remaining nervures and stigma blackish brown.

Length (h.+th.+t. 1+2) : 14 to 14·5 mm.

Male.—Clypeus decidedly longer than wide ; the apical, free part slightly longer than the interocular portion ; apical margin about half the width of the clypeus, distinctly though shallowly emarginate, with sharp edges. Vertex without fovea. Inner orbits but slightly farther apart on the vertex than at the clypeus. Posterior ocelli about as far from each other as from the inner orbits, but considerably farther from the posterior margin of the vertex. Antennae rather short and thick ; the flagellum gradually thickened toward the apical half ; segments 6 and 7 almost square ; 8 to 12 wider than long ; terminal hook short and thick, straight, very sharply pointed from the very base, triangular in profile, flattened and obtusely rounded off at apex when seen from above, reaching to near the base of the eleventh antennal segment. Legs short and conspicuously thickened, especially the femora. Hind femora much swollen, spindle-shaped, about three times as long as greatest width and but little flattened ; in the basal half the under side shows an oblique, broad groove, which does not reach the base and bears in its middle a short and heavy translucent spine. The hind tibiae are somewhat curved and gradually swollen in their apical half. Claws deeply bifid before the apex. Last sternite slightly flattened, uniformly and densely punctate. Clypeus yellow ; a yellow spot on the ferruginous upper plate of the mesopleura, just below the base of the wing ; outer side of tibiae broadly yellow. The remainder as in the female.

Length (h.+th.+t. 1+2) : 11·5 mm.

Orange Free State : Bothaville, 1 ♂, November 22, 1898 (H. Brauns).

Transvaal : Johannesburg, 1 ♀ (G. Kobrow).

Cape Province : Stellenbosch, 1 ♀, November 1887 (L. Péringuey), S.A. Mus.

The species was originally described from Lobatsi, Bechuanaland, and Grootfontein, South-West Africa. The female of Johannesburg (in Dr. Brauns' collection) is labelled " type," and the female of Stellenbosch (in the South African Museum) " cotype " ; but these specimens were not mentioned in the original description, although they have been identified by Dr. v. Schulthess. Cameron's *E. pulchripennis* was described from Kranspoort, Transvaal ; a specimen thus named by Cameron, in the Stockholm Museum, was recognised as *E. femoratus* by v. Schulthess (Ark. f. Zool., viii, No. 17, 1913, p. 14),

and there is nothing in Cameron's description that does not agree with such identification.

Eumenes paeneplanus, new species.

(Text-figure 2.)

Female.—Head seen in front about as broad as high. Clypeus slightly wider than long, forming a flattened hexagon in outline, moderately but rather suddenly convex in the centre, slightly flattened before the anterior margin; the anterior, free portion about as long as the basal, interocular part; the apical margin measuring about one-third of the total width of the clypeus, shallowly and evenly, though quite distinctly emarginate, with prominent, bluntly triangular edges. Vertex with a small, hairy, transverse fovea a short distance from the hind margin. Vertex and temples quite long, even longer than in *E. femoratus*, margined behind with a sharp, continuous rim; the posterior ocelli about one and one-half times as far from the hind margin of the vertex as from the inner orbits. Ocelli placed in a slightly flattened triangle, the posterior ones distinctly closer to each other than to the inner orbits, the anterior one larger. Front unusually wide and almost flat between the antennae, with the merest trace of swelling and longitudinal, impressed line above. Eyes bare, about as far apart at the clypeus as on the vertex. Mandibles shaped as in *E. femoratus*, externally ribbed and grooved, and with the row of stiff, pale setae along the outer margin; the apex, however, is hardly curved and quite obtuse, while the teeth along the inner margin are oblique and blunt. Maxillary and labial palpi as in *E. femoratus*. Antennae quite short and stout, the flagellum more distinctly swollen in the apical half than in *E. femoratus*; segments, 7 nearly square, 8 to 11 distinctly wider than long, 12 about as long as wide at base. Thorax quite elongate and depressed; conspicuously flattened on the dorsal as well as on the ventral side; about two and one-half times as long as high in profile; quite wide seen from above, being less than one and one-half times as long as wide. Pronotum very broadly and squarely truncate anteriorly; margined with a collar-shaped, translucent, pale lamella, which is much more pronounced than in *E. femoratus*; laterally the lamella is evenly curved backward, so that the humeral angles, though well marked, are quite blunt; the pronotum is but slightly narrower anteriorly than before the base of the wings. Mesonotum quite slightly and very evenly convex, about as long as wide, with a median, smooth line in its

anterior third. Scutellum and postscutellum flattened, but very slightly sloping, being still part of the dorsal surface of the thorax; the scutellum with a rather superficial, impressed, median line in its anterior half. Propodeum elongate, seen from above about as long as the scutellum, distinctly composed of a dorsal face which continues the gentle slope of the postscutellum, and a vertical, posterior aspect; quite gently rounded off on the transition between the two areas; seen from above the two halves of the propodeum are quite bulging posteriorly, being separated by a deep and broad groove, which

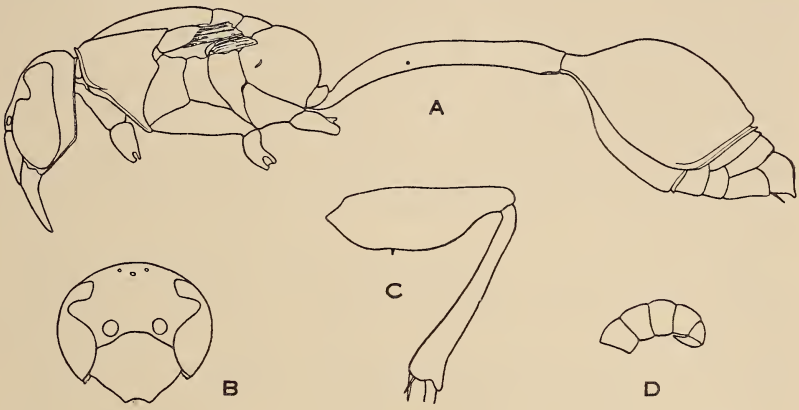

Fig. 2.—*Eumenes paeneplanus*, J. Bequaert. *A*, female in profile; *B*, anterior view of head of female; *C*, anterior view of hind femur and tibia of male; *D*, terminal segments of male antenna.

continues dorsally to the postscutellum as a deep but narrow channel. Mesopleura without carinae along the epicnemial depressions for the fore and middle legs; these depressions quite strongly marked. Mesosternum unusually long and conspicuously flattened. Legs stout and short, as in *E. femoratus*; middle and hind tibiae with stiff, pale setae on the outer surface and a dense comb of pale spines at the outer apex. Middle tibiae with one spur. Claws with an inner tooth shortly before the apex. Wings short and wide, the venation showing the same peculiarities as in *E. femoratus*. First abdominal segment quite long and slender, much longer than the thorax, but distinctly shorter than head and thorax, about eight times as long as its greatest width seen from above; in profile but little and quite gently curved, uniformly thick throughout except at the extreme base; dorsally it is not appreciably flattened, except just before the apex, without trace of groove; it very gradually widens to the basal third, where the spiracles form low, lateral protuberances, so that the

segment is here about as wide as at the apex ; between the apex and the spiracles the sides are very gently and slightly curved inward. Second segment with a short, but distinct, basal neck, regularly campanulate, a little more convex dorsally than ventrally, much longer than high in profile, the swollen portion slightly longer than wide seen from above ; not in the least compressed ; the hind margin conspicuously duplicate, as in *E. femoratus*. The second sternite is distinctly depressed and somewhat concave in the middle over its basal third. Puncturation of the head as in *E. femoratus*, very deep and coarse on the clypeus ; that of the thorax somewhat finer, the smooth intervals between the punctures being larger, so that the thorax is much more shiny ; there is a smooth area along the apical margin of the postscutellum, quite conspicuous in the middle. First tergite with quite scattered and minute punctures, which are but little larger in the middle of the basal half. The puncturation of the second and succeeding segments as in *E. femoratus*. Pubescence as in *E. femoratus*.

Black, rather inconspicuously marked with ferruginous red (often shading into brown) as follows: clypeus, mandibles, basal half of antennae, a spot at the bottom of ocular sinus, the temples quite extensively, pronotum (except extreme lower edges), tegulae, the upper plate of mesopleura, scutellum (except anteriorly), postscutellum, propodeum (except for black margins and median line), legs (hind tibiae and middle and hind tarsi black, with ferruginous last tarsal segment), first abdominal segment (except for a dorsal, black band, much narrowed near the base), second segment broadly at base and narrowly at apex, the ferruginous colour spreading somewhat over the sides of the sternite. Apex of the first tergite with two triangular, ivory-white spots, confluent or separated in the middle ; the hind tibiae with a narrow, ivory-white line along the outer surface ; a narrow, ivory-white line along the anterior margin of the pronotum. Wings decidedly smoky, except in the posterior half of the hind wings ; with purplish tinge, but without the golden reflections of *E. femoratus*. The two females seen, although from quite distant localities, are astonishingly alike in coloration.

Length (h.+th.+t. 1+2) : 16 mm.

Male.—Clypeus more elongate than in the female, about as long as wide ; the apical margin as deeply and broadly emarginate as in the female, but the edges much sharper. Vertex without fovea. Posterior ocelli nearly twice as far from the hind margin of the vertex as from the inner orbits and slightly farther from each other than from

the eyes. Antennae quite short and thick, the flagellum conspicuously swollen; segments 5 and 6 almost square, 7 to 12 much wider than long; terminal hook shaped as in the male of *E. femoratus*. Legs short and conspicuously thickened as in *E. femoratus*; the hind femora somewhat less swollen, about three and one-half times as long as greatest width; in the basal half, where the femora bear the same heavy, short spine as in *E. femoratus*, the under side is obliquely depressed, but not grooved; the hind tibiae are but slightly curved. Claws deeply bifid before the apex. Clypeus ivory-white with a ferruginous median spot; an ivory-white line on the under side of the scape; pale spots on the under side of the antennal segments 9 to 11; the anterior margin of pronotum more distinctly ivory-white than in the female; apical ivory-white markings on the first tergite as in female; broad apical ivory-white bands on tergites 3 to 7 and on sternites 3 to 6, bisinuate anteriorly; the outer surface of all the tibiae and of the basal segment of the tarsi rather broadly ivory-white. The remainder as in the female.

Length (h.+th.+t. 1+2): 12·5 mm.

Rhodesia: Lonely, 1 ♀ (holotype), May 13, 1913 (H. Swale), S.A. Mus.

Transvaal: Barberton, 1 ♀ (paratype), November 11 (H. Edwards).

Natal: Mfongosi, 1 ♂ (allotype), March 1914 (W. E. Jones), S.A. Mus.

This species, though evidently allied to *E. femoratus*, is readily distinguished by the unusually depressed thorax. The flattening of the thorax has sometimes been regarded as a characteristic of *Pareumenes*, but the present species shows that this peculiarity is not of generic value among the Eumeninae.

Subgenus Eumenes proper.

Eumenes pomiformis (Rossi).

Vespa pomiformis, Rossi, Fauna Etrusca, 1790, p. 85.

Eumenes pomiformis, H. de Saussure, Et. Fam. Vesp., i, 1852, p. 29 (♀♂); iii, 1856, p. 128.

Labus superbus, G. Meade Waldo, Ann. Mag. Nat. Hist., (8), v, 1910, p. 36 (♂).

This Palaearctic species is found in Egypt and Libya and enters the extreme north-eastern part of the Ethiopian region. It is here mainly included to publish the synonymy of *Labus superbus*, of which I have examined the type, from the White Nile, at the British Museum.

I am unable to distinguish it from *E. pomiformis*, and the identity of the two had apparently been recognised by the late Meade Waldo, since the specimen was placed with *E. pomiformis* in the collection.

It is generally supposed that *E. pomiformis* is but a variation of the common Palaearctic *E. coarctatus* (Linnaeus); but, with the limited material before me, it appears quite distinct. The punctuation of the second abdominal tergite and sternite is much more pronounced and denser than in *coarctatus*. It is, however, not the place here to discuss these two species further.

Eumenes braunsianus, A. v. Schulthess.

(Text-figure 3.)

Eumenes (*Eumenidion*) *braunsianus*, A. v. Schulthess, Societas Entomol., xxviii, 1913, p. 2 (♀♂). J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, p. 275.

Female.—Head seen in front distinctly broader than high. Clypeus slightly longer than wide, evenly convex in the basal two-thirds, gradually sloping anteriorly; the anterior, free portion a little shorter than the upper, interocular part; the anterior margin broadly truncate, with a distinct, though shallow emargination and obtusely rounded edges. Vertex without fovea. Posterior ocelli slightly farther from each other than from the eyes; the anterior ocellus distinctly larger. Front raised into a low carina between the antennae. Eyes bare, their inner margins slightly farther apart on the vertex than at the clypeus. Vertex and temples narrow, margined behind with a continuous, sharp rim. Mandibles elongate, slender, decussate, straight, with broad and obtuse, rather indistinct, teeth along the inner margin. Antennae elongate; the flagellum moderately and quite gradually swollen toward the apical half; segments—7 and 8 almost square, 9 to 11 wider than long, 12 about as long as wide at the base. Thorax subglobular, slightly longer than high in profile, more distinctly longer than wide seen from above. Pronotum straightly truncate anteriorly, the margin with a slightly raised carina which appears somewhat flattened and is much sharper on the sides, below the humeral angles; humeral angles prominent, but very obtusely rounded off. Mesonotum somewhat longer than wide, anteriorly with a slightly impressed, median line. Scutellum convexly swollen, transverse, with an impressed, median, longitudinal line anteriorly. Postscutellum very slightly convex. Propodeum very short, moderately and broadly grooved on the middle line behind the postscutellum, more deeply so

above the insertion of the abdomen. Sides of propodeum moderately swollen, completely rounded off, without ridges or projecting angles. Mesopleura without carinae along the epicnemial depressions for the fore and middle legs. Legs normal. Venation of wings of the usual *Eumenes* type. First abdominal segment long and slender, slightly longer than the thorax, but shorter than head and thorax, about three and one-half times as long as its greatest width seen from above ; in profile distinctly curved and much more swollen in its apical than in its basal half, the transition between the two portions being rather

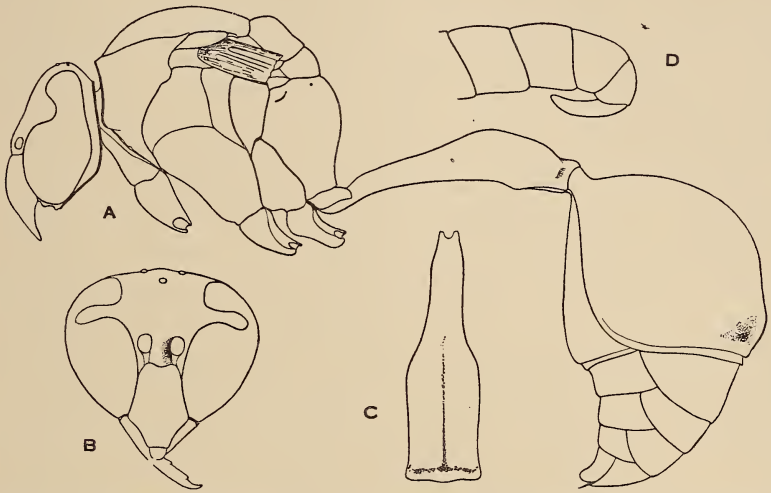

Fig. 3.—*Eumenes braunsianus*, A. v. Schulthess. *A*, female in profile ; *B*, anterior view of head of male ; *C*, first tergite of female from above ; *D*, terminal segments of male antenna.

gradual ; seen from above the apical half is nearly parallel-sided, distinctly flattened above, about two and one-half times as wide as the basal, stalk-like portion, the passage between the two being rather abrupt ; the spiracles placed about midway the length of the segment and hardly projecting ; dorsally there is a faint longitudinal groove toward the apex and a transverse, preapical depression. Second segment quite large, conspicuously swollen and nearly as long and high as the thorax in profile, bell-shaped and enclosing the greater part of the succeeding segments ; in profile it is about as high as long and moderately compressed ; basal neck extremely short ; apical margin duplicate ; the terminal lamella thin, membranous, smooth, separated by a deep groove from the preapical thickening. In the apical half the second tergite is raised along the middle line and

pinched shortly before the apex, due to the presence of a slight depression on each side of the median, raised portion. Puncturation quite dense and moderately coarse on head and thorax, including the propodeum ; epicnemial face of mesopleura, metapleura, and posterior half of tegulae nearly smooth and impunctate. Clypeus smooth and shiny, with very few, extremely minute and much scattered punctures in its basal half only. Groove of the propodeum rather coarsely rugose, somewhat obliquely wrinkled in its lower half. First tergite with scattered punctures, which are finer than on the thorax ; those of the second tergite still more minute, quite superficial on the sides and on the preapical swelling ; coarser and denser on the middle, before the apex. Pubescence long, erect, abundant, and greyish-white on head and thorax ; more silvery on sides of thorax, propodeum, and legs. Abdomen almost bare ; the second tergite with a brownish, somewhat golden bloom due to very short hairs.

Black, with abundant ferruginous red markings, as follows . mandibles ; labrum ; clypeus, except the extreme lateral margins ; a transverse spot between the antennae, not connected with the clypeus ; a narrow line along the upper half of the posterior orbits ; segments 1 to 8 of the antennae ; pronotum, except for the extreme lower angle above the legs, and a broad, black sinus before the base of the wing ; a transverse spot on the upper plate of the mesopleura ; tegulae and apex of post-tegulae ; anterior half of scutellum ; major part of postscutellum ; two large, triangular spots on propodeum, broadly separated medially ; the broader apical half of the first abdominal segment, except for a median dorsal band gradually widened anteriorly and not quite reaching the apex ; three large spots on second tergite ; two placed in the basal half, a short distance from the neck ; the third triangular, placed on the middle of the posterior half, and continuing on the sides along the apical margin to connect with the two basal spots (the second tergite is thus ferruginous with a black design in the shape of a reversed Y) ; apical half of second sternite and of third tergite, and remainder of abdomen ; legs, except for the coxae and the middle and hind trochanters. A narrow, pale yellow band covers the apical, swollen margin of the first tergite. Occasionally the clypeus, mandibles, and postscutellum, and perhaps some other parts, may be more orange-red than ferruginous. The posterior transverse ridges, connecting the sides of scutellum and postscutellum with the base of the wings, are pale coloured, more or less translucent. Wings but feebly smoky, with a slight horny-yellow tinge, darker toward the costa, faintly violaceous in the radial cell.

Length (h.+th.+t. 1+2) : 13·5 to 14·5 mm.

Male.—Clypeus relatively narrow, much longer than wide ; the anterior, free portion but little more than half the length of the interocular, upper part ; its apical margin broadly truncate, almost straight, with bluntly rounded edges. Head relatively higher than in the female ; the inner orbits nearly twice as far apart on the vertex as at the clypeus. Flagellum elongate, moderately thickened in the apical half ; antennal segments 8 to 12 slightly broader than long ; terminal hook moderately long, reaching about midway the tenth antennal segment when folded beneath the flagellum, straight and uniformly thick, gradually tapering at the obtuse apex. Legs normal. Second abdominal tergite somewhat more strongly pinched before the apex. Last (seventh) sternite uniformly convex and shiny, not in the least depressed, obtusely pointed at apex. Clypeus entirely pale yellow ; a small, yellowish spot above the clypeus and a minute yellow dot in the extreme lower corner of the inner orbits ; pronotum almost wholly ferruginous ; sternites 2 to 6 with pale yellow fasciae, quite wide on the fifth and sixth ; seventh sternite with a large, subcircular, pale yellow spot. The remainder as in the female.

Length (h.+th.+t. 1+2) : 13 mm.

E. braunsianus is the Ethiopian representative of a type of *Eumenes* more frequently found in the Nearctic region (*E. bollii*, Cresson, and *E. belfragei*, Cresson). In the strongly bell-shaped second tergite it approaches *E. peringeyanus*, from which it is readily separated by the much shorter and broader first abdominal segment.

Cape Province : Algoa Bay, 1 ♀, January 16, 1897 (holotype of the species) and 1 ♂, December 20, 1896 (H. Brauns) ; Maseru, Basutoland, 1 ♀ (Dicterlen), S. Afr. Mus.

A. v. Schulthess records it from Johannesburg, Transvaal. This is, however, not the type locality of the species, as I have stated by error in my catalogue of Ethiopian wasps. A. v. Schulthess designates the female from Algoa Bay, in Dr. Brauns' collection, as the type.

Eumenes peringeyanus, A. v. Schulthess.

(Text-figure 4.)

Eumenes (*Eumenidion*) *peringeyanus*, A. v. Schulthess, Societas Entomol., xxviii, 1913, p. 2 (♀). J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, p. 283.

Female.—Head seen in front slightly broader than high. Clypeus distinctly longer than wide, evenly convex in the middle ; the anterior,

free portion much shorter than the interocular part; apical margin deeply, but broadly, arcuately emarginate, with triangular, flattened, bluntly rounded edges. Vertex without fovea. Ocelli in a much flattened triangle; posterior ocelli farther from each other than from the eyes; anterior ocellus distinctly larger. Front but slightly raised between the antennae, not in the least carinate. Eyes bare; their inner margins about one and one-half times as far apart on the vertex as at the clypeus. Vertex and temples narrow, margined behind with a continuous, sharp carina. Mandibles moderately elongate and slender, decussate, straight, with slightly curved apex and three distinct, but broad and obtuse, teeth along the inner margin. Antennae elongate; the flagellum much swollen in its apical half, where it is about twice as thick as at the base; segments—7 almost square, 8 to 11 much wider than long, 12 about as long as wide at the base. Thorax subglobular, slightly longer than high or wide, seen in profile or from above. Pronotum straightly truncate anteriorly, margined with an extremely fine carina, which is more prominent on the sides above the fore coxae. Humeral angles quite indistinct, very broadly rounded off. Mesonotum quite convex, about as long as wide, with a faint trace of anterior, median line. Scutellum moderately swollen, with an impressed, longitudinal line anteriorly. Postscutellum hardly convex. Propodeum very short, not grooved in the upper half, where it merely shows an impressed, longitudinal line; moderately and narrowly excavated in the lower half. Sides of propodeum hardly swollen, uniformly rounded off, without ridges or projecting angles. Mesopleura without carinae bordering the epicnemial depressions for the fore and middle legs. Legs normal, slender. Venation of the usual *Eumenes* type. First abdominal segment very long and slender, a little longer than head and thorax, four and one-half to five times as long as its greatest width seen from above; in profile evenly curved and quite gradually and moderately thickened from base to before apex; seen from above the segment widens quite gradually from base to middle, the apex being about twice the width of the base; dorsally it is not flattened and bears only a short, longitudinal groove just before the apex; spiracles placed about midway and but faintly projecting. Second segment quite large, conspicuously swollen dorsally and much compressed, bell-shaped; in profile it is as high as the thorax and about as high as long; seen from above it is about one and one-half times as long as wide, due to its compressed shape; basal neck short; apical margin duplicate; the terminal lamella long and thin, membranous, smooth, separated by a deep, foveolate groove

from the preapical swelling ; the preapical thickening is preceded on the middle line by a transverse, shallow depression. Puncturation quite dense and moderately coarse on head and thorax, including the propodeum ; metapleura, epicnemial face of mesopleura, and tegulae smooth and nearly impunctate. Clypeus smooth and shiny, impunctate except in its upper half, where there are a few, scattered, fine punctures. First and second tergites fairly uniformly covered with medium-sized and moderately dense punctures, which are some-

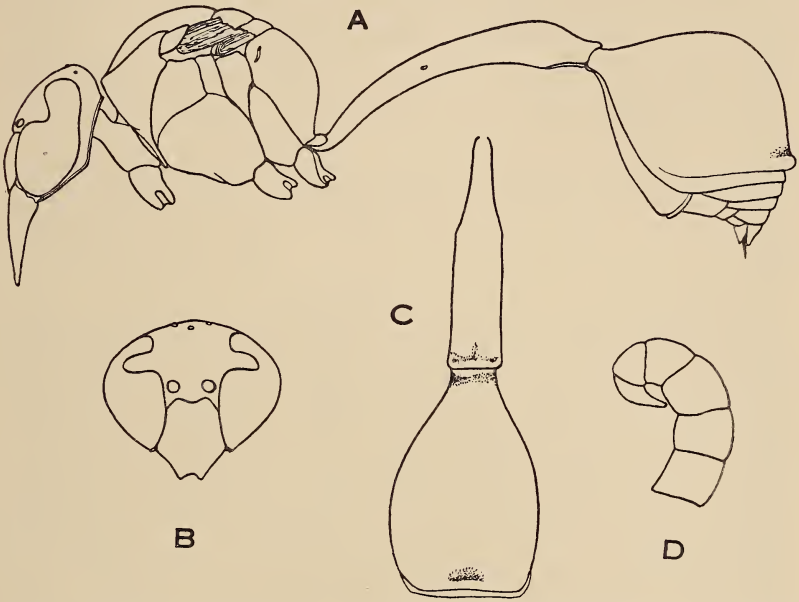

Fig. 4.—*Eumenes peringeyanus*, A. v. Schulthess. *A*, female in profile ; *B*, anterior view of head of female ; *C*, first and second tergites of female from above ; *D*, terminal segments of male antenna.

what larger along the middle of the first tergite and become quite fine and scattering on the sides of the second. Pubescence long, erect, dense, greyish-white on head and thorax, somewhat silvery on clypeus, sides of thorax, propodeum, and legs ; short but dense on abdomen.

Black, abundantly marked with ferruginous and yellow as follows : clypeus yellow, more orange in the upper part, where it shades into ferruginous in the centre ; a yellow elongate mark between the antennae ; a yellow line along the outer orbits in the upper half of the temples ; mandibles and antennae ferruginous, the tip of the scape and the 7th to 12th segments above blackish brown ; pronotum ferruginous, broadly yellow along the anterior, and narrowly so along

the posterior margin ; tegulae ferruginous ; a large, ferruginous spot on the mesopleura ; scutellum yellow, margined with ferruginous ; postscutellum yellow ; two large yellow spots on propodeum, margined with ferruginous ; legs ferruginous ; the outside of the tibiae and the tip of the fore and middle femora externally yellow ; first abdominal segment ferruginous on the sides and before the apex, the apical margin narrowly yellow and a faint, yellowish spot on each side in the apical third ; second tergite with a black mark of the shape of a reversed Y : the preapical yellow margin widens in the middle into a triangle in which the transverse depression stands out as a brown spot ; on each side of the tergite there is a broad triangular yellow spot ; these yellow markings of the second tergite are all margined with ferruginous ; remainder of the abdomen ferruginous, the second sternite blackish at base and with preapical yellow fascia ; the other sternites faintly marked with yellow. Wings subhyaline, very slightly smoky, with violaceous tinge along the anterior margin and in the radial cell.

Length (h.+th.+t. 1+2) : 12 to 13·5 mm.

Male (undescribed).—Clypeus much longer than wide, considerably narrowed in its upper part ; the free, apical portion only half as long as the interocular part ; its apical margin shaped as in the female. Inner orbits twice as far apart on the vertex as at the clypeus. Mandibles not appreciably notched along the inner margin. Flagellum conspicuously thickened in the apical half ; the 8th to 12th antennal segments slightly wider than long ; terminal hook short and thick, wedge-shaped in outline, slightly curved, gradually tapering to a sharp apex, which reaches midway the tenth antennal segment. Legs normal. Last (seventh) sternite slightly convex and smooth in the centre, somewhat depressed and deeply punctate before the slightly thickened margin, very broadly rounded off at apex. Clypeus entirely yellow ; most of the other yellow markings of the female are ferruginous, but the apical fasciae of the first and second tergites are yellow and the succeeding tergites are also more or less marked with yellow. The remainder as in the female.

Length (h.+th.+t. 1+2) : 11 mm.

The coloration is evidently variable. The above description is based on a pair taken by Dr. H. Brauns at Willowmore. In the type, and two other specimens at the South African Museum, the yellow has replaced most of the ferruginous red colour, especially on the thorax. Structurally, however, all these specimens are alike.

Cape Province : Prieska, 3 ♀, one being the type, S. Afr. Mus. ;

Willowmore, 1 ♀, December 1, 1920, and 1 ♂ (allotype), October 20, 1919 (H. Brauns).

A. v. Schulthess records it also from Deelfontein, Cape Province. He evidently overlooked the locality of the type specimen, which is on the label in Péringuey's handwriting ; the two other specimens of the South African Museum, part of the original lot, bear the letter P, presumably an abbreviation of Prieska.

Eumenes fülleborniánus, A. v. Schulthess.

Eumenes fülleborniánus, A. v. Schulthess, Societas Entomol., xxv, 1910, p. 18 (♀♂). J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, p. 276.

Southern Rhodesia : Victoria Falls, 1 ♀, March 1, 1920, Rhodesia Museum.

Portuguese East Africa : Amatongas Forest, 1 ♀ and I ♂, February 1917, Rhodesia Museum.

The morphological peculiarities are described and figured for *E. langi*, in which I now recognise a colour race of *E. fülleborniánus*. The typical form, of East Africa, is black, more or less extensively ferruginous on pronotum, mesopleura, sides of propodeum, under side of abdomen (especially on the first segment), legs, mandibles, and under side of antennae. In the three specimens examined the only pale yellow markings are a short line along the outer orbits in the upper part of the temples, a faint indication of posterior margin of pronotum in the centre, and a broadly interrupted apical band on the first tergite. The clypeus of the male is black, with somewhat ferruginous apical edges.

This is the smallest of the Ethiopian *Eumenes* and should be readily recognised by the coarsely sculptured, almost foveolate second tergite, as well as by the peculiar shape of the first abdominal segment.

The species was originally described from Zanzibar and Lake Nyasa.

Eumenes fülleborniánus var. *langi*, J. Bequaert.

Eumenes langi, J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 56, 85 (♀ ; figs. 71–73), and 276.

This is evidently the West African form of *E. fülleborniánus*, from which it differs merely in the almost total absence of ferruginous markings. It was described on a unique female from Boma, Belgian

Congo, which had many, irregular, transverse wrinkles on the posterior half of the second tergite. Three additional specimens from the Belgian Congo do not possess these wrinkles, but instead the second tergite is coarsely punctate as in the East African *E. fülleborniánus*. Since I am unable to find other differences, I must regard the wrinkling in the type specimen as abnormal and due to some injury during the pupal stage.

A female of the var. *langi* in the Congo Museum, at Tervueren, Belgium, was obtained in the Manyema by R. Mayné. It is still more black than the type; the under side of the three last antennal segments, the mandibles and fore tibiae are slightly ferruginous; the apex of the fore tibiae is spotted with pale yellowish on the outer side; the only pale yellow markings of the abdomen are a small apical spot on each side of the first tergite; the pronotum bears a narrow whitish line medially, along the hind margin. This specimen reaches 11 mm. (h.+th.+t. 1+2).

Male of var. *langi* (undescribed).—Head relatively higher than in the female. Clypeus more elongate, considerably narrowed above, about twice as long as wide; the apical margin quite shallowly sinuate; the free, apical portion only half as long as the interocular part. Inner orbits twice as far apart on the vertex as at the clypeus. Flagellum moderately and quite gradually swollen; antennal segments 9 to 12 slightly wider than long; the hook-like segment rather small, wedge-shaped, much narrowed into a very long, narrow, and sharp apex, which reaches the base of the eleventh antennal segment. Legs normal. Seventh sternite uniformly convex and shiny. The remainder as in the female; the coloration also similar. In one specimen the clypeus is entirely black, densely covered with silvery pile; a small, whitish dot above the base of antennae; a short, whitish line along outer orbits in upper part of temples; the posterior margin of pronotum narrowly whitish in the middle; whitish outer edges of the apex of first tergite; a narrow, whitish line on each side on the preapical swelling of second tergite; and a whitish streak on the outer side of the fore tibiae. The other male has only the white dot above the base of the antennae and white line of the outer orbits, being otherwise completely black.

Length (h.+th.+t. 1+2): 7·5 to 8 mm.

The two male specimens on which the foregoing description is based were collected by Maurice Bequaert, at Coquilhatville, Belgian Congo, October 15, 1922.

Eumenes oculihirtus, new species.

(Text-figure 5.)

Female.—Head seen in front much broader than high. Clypeus slightly longer than wide, elongate hexagonal, quite evenly convex toward the centre; the anterior, free portion but two-thirds the length of the upper, interocular part; the apical margin nearly half the total width of the clypeus, with a moderately deep, broadly open, arcuate emargination and extremely obtuse, broad edges. Vertex without fovea. Ocelli placed in a flattened triangle; posterior ocelli slightly farther apart than from the inner orbits; the anterior ocellus considerably larger. Front very slightly raised but not carinate between the antennae. Eyes densely covered all over with long, erect, greyish-white pubescence, quite apparent under a magnification of 10 diameters; the inner orbits much farther apart on the vertex than at the clypeus. Vertex and temples narrow, margined behind with a continuous, sharp rim. Mandibles elongate, slender, decussate, straight; with a curved, sharp apex and three broad, oblique, obtuse but quite strong teeth along the inner margin. Antennae moderately elongate; the flagellum conspicuously swollen in its apical half; segments—8 almost square, 9 to 11 wider than long, 12 about as long as wide at base. Thorax subglobular, about one-sixth longer than high seen in profile, and but little longer than wide seen from above. Pronotum not quite straightly truncate anteriorly; the margin completely rounded off and smooth in the middle; on the sides (dorsally) with an extremely fine, raised line, which is not visible with a hand lens of 10 diameters; below the humeral angles there is a more distinct, but flattened and blunt, vertical carina, which is deeply sinuate about the middle of its length. Humeral angles hardly defined, very obtusely rounded off. Mesonotum somewhat longer than wide, with a smooth but rather dull line in the middle of its anterior half. Scutellum quite uniformly swollen, the anterior, horizontal half gradually rounded off into the posterior, sloping portion; with a median, smooth, slightly raised, longitudinal line. Postscutellum hardly convex and entirely within the posterior, vertical slope of the thorax; divided by a fine, median, longitudinal furrow. Propodeum extremely short seen from above, but little convex, completely rounded off, without ridges or projecting angles; the median groove reduced to a very fine, impressed line in the upper half; moderately deep and quite wide in the lower portion. Mesopleura without carinae or ridges along the epicnemial depressions for

the fore and middle legs. Legs normal, slender. Venation of wings of the usual *Eumenes* type. First abdominal segment quite long and slender, but little shorter than head and thorax, about five times as long as its greatest width seen from above ; in profile distinctly but quite gently curved, slightly and quite gradually swollen toward the apical half ; seen from above the tergite widens very gradually from the base to just before the middle, where the spiracles are slightly protuberant ; thence the increase is quite slow to the apex, which is the widest part of the tergite ; dorsally the segment is not appreciably flattened, but its apical half bears a longitudinal, shallow groove, which becomes more distinct posteriorly. Second segment quite

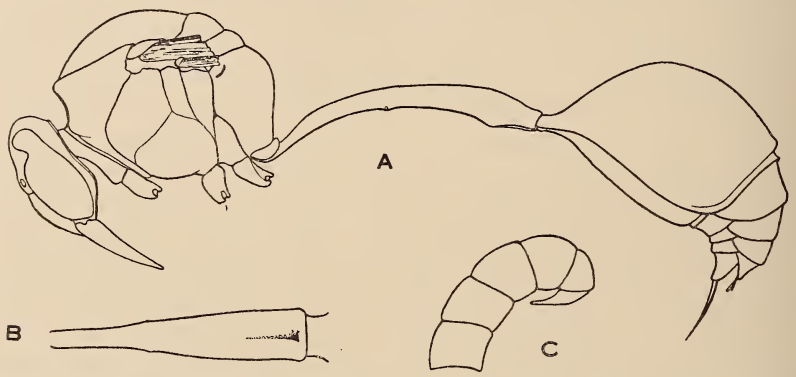

Fig. 5.—*Eumenes oculihirtus*, J. Bequaert. *A*, female in profile ; *B*, first tergite of female from above ; *C*, terminal segments of male antenna.

large, bell-shaped, conspicuously more swollen dorsally than ventrally, but not in the least compressed ; but slightly longer than high in profile ; basal neck short, but distinct ; apex or sternite and tergite duplicate ; the terminal lamella quite thin, translucent, flat, separated from the preapical swelling by a minutely foveolate, deep furrow ; second sternite flat at base. Head and thorax dull, rather sparsely covered with scattered punctures of medium size ; they are somewhat coarser on scutellum, postscutellum, and posterior part of propodeum ; clypeus impunctate, dull. First abdominal tergite with very few, minute punctures, almost impunctate ; second tergite fairly uniformly covered with moderately dense punctures, similar to those of the mesonotum ; they are quite sparse and minute on the second sternite ; the remainder of the abdomen impunctate. Pubescence quite long and dense on head, thorax, and abdomen, giving to the insect a dull, greyish appearance ; there is also an admixture of shorter, somewhat silvery tomentum, especially striking on the clypeus.

Black, with scant and dull ferruginous markings as follows : clypeus (except for a large, median, black spot in the upper half), mandibles, scape (except for a black line on the upper side) and under side of flagellum, pronotum (except for a large black spot on each side), margins of tegulae, posterior two-thirds of scutellum, the sides of propodeum quite broadly, the legs (except for the black middle and hind tarsi), the under side of the first abdominal segment, the extreme sides of the second tergite, and most of fourth to sixth segments. Ivory-white markings are reduced to a narrow, transverse fascia a short distance before the apex of the postscutellum ; narrow, almost linear, apical fasciae on the first tergite and on the second tergite and sternite ; a preapical, median streak on the third tergite ; a line along the outer orbits in the upper part of the temples ; and a line on the upper (outer) surface of middle and hind tibiae. Wings subhyaline, smoky and purplish before the stigma and in the radial cell.

Length (h.+th.+t. 1+2) : 13 to 14 mm.

Male.—Clypeus much longer than wide ; the anterior, free portion only half as long as the interocular part ; the apical margin emarginate as in the female. Inner orbits twice as far apart on the vertex as at the clypeus. Flagellum rather conspicuously swollen in the apical half, where the segments are slightly beaded ; antennal segments, 8 almost square and 9 to 12 wider than long ; terminal hook long and slender, slightly curved, narrowed from the very base to a long and very sharp point, which reaches about midway the tenth antennal segment. Legs somewhat shorter than in the female, but otherwise normal. Last sternite normally convex, impunctate. The remainder as in the female. The coloration is almost exactly that of the female ; but the clypeus is entirely ferruginous in the allotype and ivory-white with a large ferruginous spot in the paratype ; the ferruginous sides of the second tergite are angularly produced toward the middle ; and there are also ivory-white, sinuate fasciae on tergites and sternites 3 and 4.

Length (h.+th.+t. 1+2) : 12 to 13 mm.

Rhodesia : Bulawayo, 1 ♀ (paratype), April 23, 1912 (G. Arnold), Rhodesia Mus.

Natal : Mfongosi, 1 ♀ (holotype) and 2 ♂ (allotype and paratype), March and April 1916 (W. E. Jones), S.A. Mus.

E. oculihirtus differs from all other Ethiopian *Eumenes* in the densely pubescent eyes. This appears to be a most unusual peculiarity among the Eumeninae, where I know personally of no other case. Brèthes, however, states that a few Argentinian *Eumenes* of the subgenus

Omicron (such as *E. spegazzinii*, Brèthes, *E. argentinus* (Berg), and others) have traces of villosity on the eyes, visible only with the proper magnification (An. Mus. Nac. Buenos Aires, (3), vi, 1906, p. 312). In the species here described, the pile of the eyes is quite long and abundant.

The nearest ally appears to be *E. lucasius*, which, however, is quite distinct in the bare eyes, the much broader clypeus of the female, the broader and relatively shorter first tergite, and the coarse and dense puncturation of head, thorax, and first tergite.

Eumenes lucasius, H. de Saussure.

(Text-figure 6.)

Eumenes lucasia, H. de Saussure, Et. Fam. Vesp., i, 1852, p. 68 (♂).
Eumenes lucasius, J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, p. 278 (♀♂).
Rethus broomi, P. Cameron, Rec. Albany Mus., i, 2, 1904, p. 110 (♂).
Eumenes schultzeanus, A. v. Schulthess, Societas Entom., xxv, 1910, p. 19 (♀♂).

Female.—Head seen in front slightly broader than high. Clypeus about as long as wide, almost hexagonal in outline, quite evenly convex toward the centre; the anterior, free portion about two-thirds the length of the upper, interocular part; the apical margin nearly half the total width of the clypeus, with a distinct, broadly arcuate emargination and blunt, triangular edges. Vertex with fovea. Ocelli placed in a flattened triangle; posterior ocelli a little farther apart than from the inner orbits; anterior ocellus much larger. Front slightly raised and bluntly carinate between the antennae. Eyes bare, much farther apart on the vertex than at the clypeus. Vertex and temples narrow, margined behind with a continuous, sharp rim. Mandibles elongate, slender, decussate, straight, with a curved, sharp apex and three broad, obtuse, oblique teeth along the inner margin. Antennae moderately elongate; the flagellum gradually swollen in its apical half; antennal segments—6 nearly square, 7 to 11 wider than long, 12 about as broad as long. Thorax short oval, about one-fifth longer than high seen in profile, and distinctly longer than wide seen from above. Pronotum squarely truncate anteriorly; its anterior margin rounded off and almost blunt, with a mere trace of raised line toward the sides (dorsally); below the humeral angles there is a blunt, vertical carina, deeply sinuate about midway. Humeral angles but poorly defined and broadly rounded off. Mesonotum slightly longer

than wide, with a fine, longitudinal, impressed line over the anterior two-thirds. Scutellum quite uniformly swollen and almost entirely comprised in the dorsal face of the thorax; with a median, longitudinal line, which is slightly raised in the anterior half. Postscutellum hardly convex and entirely within the posterior slope of the thorax, without any trace of median line. Propodeum short seen from above, moderately convex, completely rounded off, without ridges or projecting angles; the median groove broad and shallow, deeper above the insertion of the abdomen, effaced behind the postscutellum. Mesopleura without carinae or ridges along the epicnemial

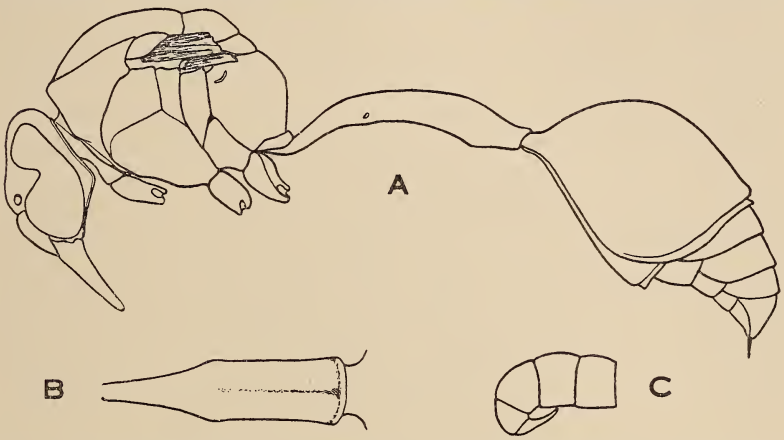

Fig. 6.—*Eumenes lucasius*, H. de Saussure. *A*, female in profile; *B*, first tergite of female from above; *C*, terminal segments of male antenna.

depressions for the fore and middle legs. Legs normal, slender. Venation of wings of the usual *Eumenes* type. First abdominal segment long and slender, about as long as the thorax in profile, about four times as long as its greatest width seen from above; in profile distinctly, but quite gently curved, slightly and quite gradually swollen toward the apical half; seen from above the tergite widens quite gradually from the base to near the middle, where the spiracles are slightly protuberant; the posterior half is nearly parallel-sided, though the segment is slightly wider at the apex; the dorsal surface is distinctly flattened, especially in the posterior half, which bears a shallow, longitudinal groove, increasing in depth to before the apex. Second segment bell-shaped, but moderately swollen, not much more convex dorsally than ventrally, very slightly compressed; about as high as long in profile, distinctly longer than wide seen from above; basal neck well developed, relatively longer and narrower than in

E. acuminatus ; apex of sternite and tergite distinctly duplicate ; the terminal lamella thin and long, translucent, flat, separated from the preapical swelling by a minutely foveolate, deep furrow ; second sternite flat at base. Puncturation quite coarse and dense on head and thorax, almost reticulate on the propodeum, where the median groove shows a series of transverse ribs in its lower half ; clypeus dull, with a few widely scattered, rather large punctures. First abdominal tergite in its posterior two-thirds with many medium-sized punctures, more remote on the sides, quite dense on the median groove. Second tergite fairly uniformly covered with sparse punctures, which are decidedly smaller than those of the first ; on the second sternite the punctures are larger, but much more scattered ; the remainder of the abdomen impunctate. Pubescence quite long and dense, greyish-white on head and thorax ; very short and sparse on abdomen.

Black, with few dull ferruginous markings as follows : clypeus, mandibles (except for the black base), under side of antennae, pronotum (except for a large black spot in the hind corners), tegulae, post-tegulae, a spot on the upper plate of the mesopleura, the major part of the scutellum, the sides of the propodeum quite extensively, the sides of the first and second abdominal segments (the ferruginous extending somewhat angularly toward the middle of the second tergite), the larger part of the succeeding segments, and the greater part of the legs (middle and hind tarsi blackish-brown). The ivory-white markings are a short line along the outer orbits in the upper part of the temples, a narrow fascia along the entire posterior margin of the pronotum, a transverse fascia over the postscutellum, a narrow apical fascia on the first tergite and on the second sternite, and a much broader one on the second tergite. Wings slightly smoky, more so along the anterior margin and in the radial cell, which is somewhat purplish.

Length (h.+th.+t. 1+2) : 11 to 12 mm.

Male.—Clypeus about one and one-half times as long as wide ; the anterior, free portion about two-thirds the length of the basal, interocular part ; the apical margin emarginate as in the female. Inner orbits twice as far apart on the vertex as at the clypeus. Flagellum rather uniformly swollen in the apical two-thirds ; antennal segments—7 nearly square, and 8 to 12 wider than long ; terminal hook moderately long and very slender, almost straight, narrowed from the very base to a long and very sharp point, which reaches about midway the tenth antennal segment. Last sternite normally convex, impunctate, except on the sides before the apex. The remainder as in the female. The coloration is also quite similar, but the clypeus is entirely ivory-

white ; sometimes the posterior margin of the pronotum is ivory-white in the middle only.

Length (h.+th.+t. 1+2) : 9 to 11 mm.

This is the most common and most widely distributed of the Ethiopian species of *Eumenes* proper. It is, however, strictly East and South African, being known from Abyssinia to Cape Town.

Katanga : Lubumbashi, 7 ♂, May and June 1920 (Mich. Bequaert).

Southern Rhodesia : Salisbury, 1 ♂, June 20, 1919 (G. Arnold), Rhodesia Mus.

Portuguese East Africa : Mt. Morumbula, 1 ♂, October 29, 1908 (C. W. Howard).

Natal : Krantzkloof, 1 ♀, April 1917, and 1 ♂, March 1915 (Marley), S.A. Mus.

Cape Province : Dunbrody, 1 ♂ (O'Neil), S.A. Mus. ; Algoa Bay, 1 ♀, March 1, 1897, and George, 1 ♂, January 20, 1920 (H. Brauns) ; Cape Town, 1 ♂, April 4, 1920 (Mich. Bequaert).

E. lucasius was originally described from Abyssinia. The synonymy of *E. schultzeanus* was recognised by A. v. Schulthess himself (Societas Entomol., xxv, 1910, p. 24) ; that of *Rethus broomi* by Cameron (Ann. Transvaal Mus., ii, 3, 1910, p. 156) and by Meade Waldo (Ann. Mag. Nat. Hist., (8), xiv, 1914, p. 404). Cameron has also synonymysed with it *Zethus favillaceus*, Walker (List of Hymenoptera collected by J. K. Lord in Egypt, 1871, p. 28), of Tajura, on the African shore of the Gulf of Aden. Whether he was correct is impossible to decide from the description alone, and it is not likely that Cameron saw Walker's type.

Eumenes arnoldi, new species.

(Text-figure 7.)

Female.—Head seen in front slightly broader than high. Clypeus slightly longer than wide, elongate hexagonal, quite gently convex over the entire surface ; the anterior, free portion about two-thirds the length of the upper, interocular part ; the apical margin about half the total width of the clypeus, rather shallowly and quite broadly arcuately emarginate, with blunt, triangular edges. Vertex without fovea. Ocelli placed in a flattened triangle ; posterior ocelli about as far apart as from the inner orbits ; anterior ocellus larger. Front slightly raised and bluntly carinate between the antennae. Eyes bare, much farther apart on the vertex than at the clypeus. Vertex and temples narrow, margined behind with a continuous, sharp rim. Mandibles elongate, wider than usual, decussate, straight ; the apex

but little curved and rather obtuse; with three blunt, broad teeth along the inner margin. Antennae moderately elongate; the flagellum gradually swollen to its apical third; antennal segments—5 distinctly and 6 slightly longer than wide, 7 almost square, 8 to 11 wider than long, 12 slightly longer than wide at base. Thorax short oval, about one-fourth longer than high in profile and distinctly longer than wide seen from above. Pronotum not quite squarely truncate; the anterior margin rimmed throughout with a very fine raised line; below the humeral angles it becomes a strong but flattened carina,

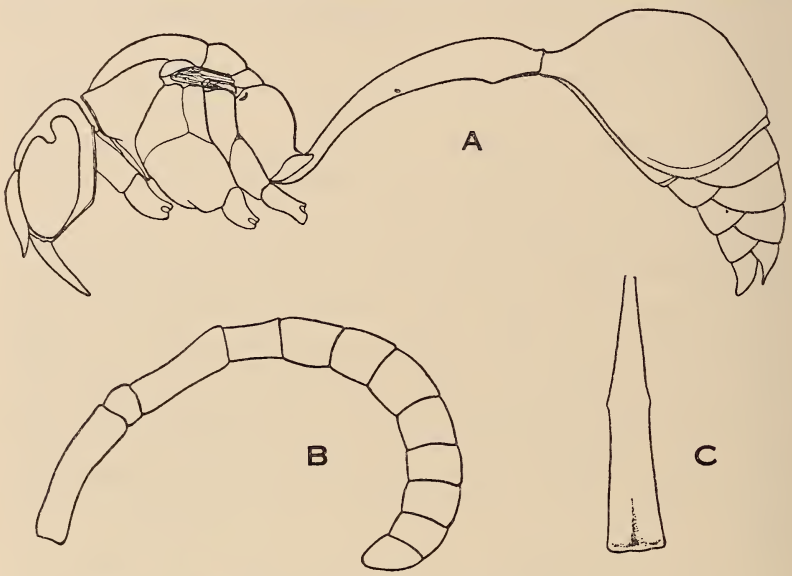

Fig. 7.—*Eumenes arnoldi*, J. Bequaert. *A*, female in profile; *B*, antenna of female; *C*, first tergite of female from above.

deeply sinuate about midway. Humeral angles inconspicuous and broadly rounded off, the dorsal aspect of the pronotum being narrow and elongate as compared with *E. acuminatus*. Mesonotum about as broad as wide, with a median, impressed, longitudinal line over its anterior half. Scutellum rather strongly, but uniformly convex; the anterior half, which is in the dorsal face of the thorax, gradually curved into the posterior, sloping part; divided by a fine longitudinal, median line, which is not appreciably raised anteriorly. Postscutellum almost flat, entirely within the posterior slope of the thorax, without any trace of median line. Propodeum quite short seen from above, moderately convex, completely rounded off, without ridges or projecting angles; the median groove broad and shallow, a little

deeper above the base of the abdomen, entirely effaced behind the postscutellum. Mesopleura without carinae or ridges along the epicnemial depressions for the fore and middle legs. Legs normal, slender. Venation of wings of the usual *Eumenes* type; the third cubital cell is relatively shorter and higher than in *E. acuminatus*, being much shorter on the cubital vein than the second. First abdominal segment quite long and slender, much more slender than in *E. acuminatus* and even more so than in *E. lucasius*, about as long as head and thorax together in profile; slightly over five times as long as its greatest width seen from above; in profile distinctly but gently curved and quite gradually swollen toward the apical third; seen from above the tergite widens quite gradually from base to apex, which is the widest part; about midway the spiracles are rather conspicuously protuberant; dorsally it is but slightly flattened and very superficially grooved, except toward the apex, where it is deeply furrowed. Second segment bell-shaped and rather strongly swollen, much more convex dorsally than ventrally, very slightly compressed; about as high as long in profile, distinctly longer than wide seen from above; basal neck well developed, relatively longer and narrower than in *E. acuminatus*; apex of sternite and tergite distinctly duplicate; the terminal lamella thin, translucent, flat, separated from the preapical swelling by a minutely foveolate, deep furrow; second sternite flat at base. Puncturation moderately coarse and dense on head and thorax; on the dorsum the punctures are somewhat finer than in *E. acuminatus*, the difference being especially marked on the pronotum; the propodeum and mesopleura, however, are not in the least subreticulate as in that species; on the mesopleura the punctures are small and remote; the base of the postscutellum is covered with a series of fine rugosities, placed more or less longitudinally; tegulae with very few, irregular punctures; clypeus dull, almost impunctate, with very few, scattered, and superficial punctures. First abdominal tergite medially with sparse and rather minute punctures. Second tergite with quite minute punctures, scattered fairly uniformly over the whole surface; those of the sternite larger, but very sparse. The remainder of the abdomen impunctate. Pubescence short and sparse, except on the head.

Black, abundantly marked with ferruginous red as follows: clypeus, mandibles, antennae (somewhat brownish on upper side), pronotum, tegulae, post-tegulae, extensive patches on mesopleura, scutellum, propodeum (except behind the postscutellum and medially), first abdominal segment (except for a median, black line dorsally,

which is wider in the basal half and broadens again before the apex), second segment (except for a wide, black, dorsal mark in the basal half, forming an inverted T), the remainder of the abdomen, and the legs (middle and hind tarsi brownish). The few ivory-white markings are much as in *E. lucasius* and *E. acuminatus* : a small spot between the base of the antennae, a short line along the outer orbits in the upper part of the temples, a narrow fascia along the posterior margin of the pronotum, a transverse fascia over the postscutellum, a narrow apical fascia on the first tergite and second sternite, a much broader one on the second tergite, apices of fore coxae and of fore and middle femora, and the outer surface of all tibiae. Wings subhyaline, but slightly smoky anteriorly and in the radial cell, which is faintly purplish.

Length (h.+th.+t. 1+2) : 12 mm.

Male unknown.

Natal : Mfongosi, 2 ♀ (holotype and paratype), March and December 1914 (W. E. Jones), S.A. Mus.

This species is closely allied to both *E. lucasius* and *E. acuminatus*, and from published descriptions it would be quite impossible to differentiate it. From both species it differs conspicuously in the shape of the first abdominal segment, which is quite slender and evenly widened from base to apex. The thorax is more slender and narrower, seen from above, than in *E. acuminatus*, from which it differs also in the finer sculpture of the mesopleura and the less thickened antennae ; the slight difference in the venation is perhaps not reliable. From *E. lucasius* it differs also in the pronotum being more distinctly rimmed along the anterior margin, and in the puncturation, which is sparser and much finer on the first and second tergites. In general aspect *E. arnoldi* is not unlike *E. oculihirtus*, but it has bare eyes and lacks the conspicuous pubescence of the body.

Named for Dr. G. Arnold, Curator of the Rhodesia Museum and distinguished student of the Hymenoptera.

Eumenes acuminatus, H. de Saussure.

(Text-figure 8.)

Eumenes (*Zeta*) *acuminatus*, H. de Saussure, Et. Fam. Vesp., iii, 1856, p. 147, pl. viii, fig. 2 (♂).

Eumenes acuminatus, J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, p. 274.

Female.—Head seen in front distinctly broader than high. Clypeus a little longer than wide, elongate hexagonal, quite gently convex

over the whole surface; the anterior, free portion but little shorter than the upper, interocular part; the apical margin about half the total width of the clypeus, rather deeply, but quite broadly, arcuately emarginate, with blunt, triangular edges. Vertex without fovea. Ocelli placed in a flattened triangle; the posterior ocelli about as far apart as from the inner orbits; anterior ocellus larger. Front slightly raised and bluntly carinate between the antennae. Eyes bare, much farther apart on the vertex than at the clypeus. Vertex and temples narrow, margined behind with a continuous, sharp rim. Mandibles moderately elongate and rather wide, decussate, straight; the apex but little curved and rather obtuse; with three blunt, broad teeth along the inner margin. Antennae rather short; the flagellum fairly uniformly thickened over most of the length; antennal segments—5 slightly longer than wide, 6 square, 7 to 11 broader than long, 12 about as long as wide at base. Thorax short, oval and somewhat depressed, about one-fourth longer than high in profile, and but little longer than wide seen from above, being conspicuously wider than in *E. arnoldi*. Pronotum nearly squarely truncate; the anterior margin rimmed throughout with a very fine, raised line; below the humeral angles it becomes a strong but flattened carina, deeply sinuate about midway. Humeral angles quite distinct, but bluntly rounded off, the dorsal aspect of the pronotum being relatively wide. Mesonotum but slightly longer than wide, with a faint trace of median, impressed line in the anterior half. Scutellum moderately and uniformly convex, very gently sloping posteriorly; divided by a fine, longitudinal, median line, which is slightly raised in the anterior half. Postscutellum almost flat, entirely within the posterior slope of the thorax, without any trace of median line. Propodeum quite short seen from above, moderately convex, completely rounded off, without ridges or projecting angles; the median groove broad and shallow, a little deeper above the base of the abdomen, almost reduced to a fine, impressed line in the upper half. Mesopleura without carinae or ridges along the epicnemial depressions for the fore and middle legs. Legs normal, slender. Venation of wings of the usual *Eumenes* type; third cubital cell relatively long, being not or but little shorter on the cubital vein than the second; first abscissa of radial vein (on first cubital cell) about twice as long as the second (on second cubital cell); the third abscissa convex into the radial cell and about as long as the two preceding abscissae together; the third cubital cell but little higher than long on the radial vein. First abdominal segment long, but moderately slender, much less so than in *E. arnoldi* and even less than

in *E. lucasius* ; about as long as the thorax in profile ; not quite four times as long as its greatest width seen from above ; in profile distinctly but gently curved and much more swollen than in *E. lucasius* and *E. arnoldi*, being thicker in the middle than at the apex ; seen from above the basal third forms a narrow stalk, which widens rather rapidly to midway, where the spiracles are hardly protuberant ; the apical half is fairly parallel-sided, nearly three times as wide as the base, flattened dorsally and with a distinct, though shallow, longi-

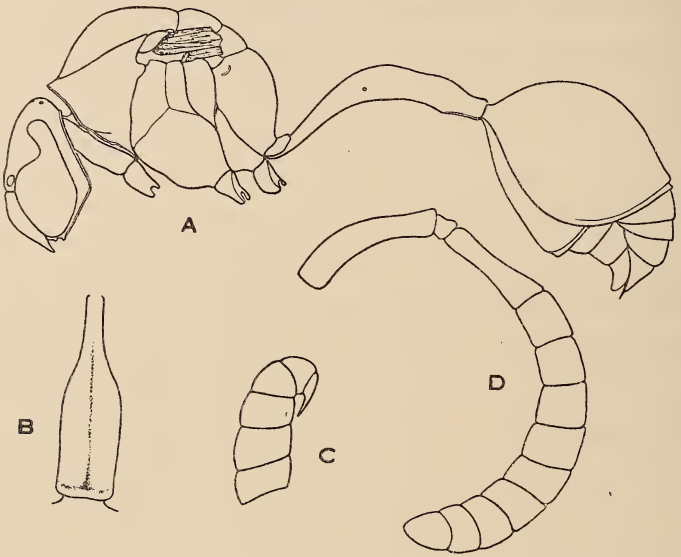

Fig. 8.—*Eumenes acuminatus*, H. de Saussure. *A*, female in profile ; *B*, first tergite of female from above ; *C*, terminal segments of male antenna ; *D*, antenna of female.

tudinal groove ; there is a distinct, transverse depression before the slightly thickened apex. Second segment bell-shaped and rather strongly swollen, much more convex dorsally than ventrally, not appreciably compressed, slightly longer than high in profile and longer than wide seen from above ; basal neck quite short and but little narrower than the apex of the first tergite ; apex of sternite and tergite distinctly duplicate ; the terminal lamella thin, translucent, flat, separated from the preapical swelling by a minutely foveolate, deep furrow ; second sternite flat at base. Puncturation quite coarse and dense on head and thorax ; the propodeum and especially the mesopleura subreticulate ; tegulae almost impunctate ; clypeus dull, its basal half with scattered, rather large punctures, which are especially conspicuous in the middle. First abdominal tergite fairly

uniformly covered with scattering, minute punctures, with a few larger ones near the middle line. Second tergite with very minute punctures, scattered all over and becoming rather indistinct toward the preapical swelling; those of the sternite very sparse and quite small. The remainder of the abdomen impunctate. Greyish-white pubescence long, erect, and dense on head and thorax; very short and sparse on abdomen; the clypeus somewhat silvery; the whole body dull, due to a brownish tomentum, especially distinct on the second tergite.

Black, abundantly marked with ferruginous as follows: clypeus (except for a median black spot near the base), mandibles (black at extreme base), antennae (brownish-black on the upper side), pronotum (except for a black spot in the posterior half), tegulae, post-tegulae, a large spot on the upper plate of the mesopleura, scutellum (except for the margins and a black median line), major part of propodeum (except the broad anterior and lateral margins and middle line), first abdominal segment ventrally and on the sides of its apical half, sides of second tergite forming broad triangular spots a short distance from the base, blotches in the apical half of the second sternite, remainder of abdomen, and legs (except for the brownish-black basal two-thirds of hind femora; the coxae somewhat brownish). The ivory-white markings are almost exactly as in *E. arnoldi*: a small, transverse spot between the base of the antennae, a short line along the outer orbits in the upper part of the temples, a line along the posterior margin of the pronotum (rather indistinct toward the base of the wings), a transverse fascia over the postscutellum, a narrow apical fascia on the first tergite and second sternite, a much broader one on the second tergite (somewhat emarginate in the middle), the extreme apex of the fore coxae, a spot near the apex of the middle tibiae, and a line on the outer surface of all the tibiae. Wings subhyaline, slightly smoky and somewhat purplish along the anterior margin and in the subcostal and radial cells.

Length (h.+th.+t. 1+2): 12 mm.

Male.—Clypeus about one and one-half times as long as wide; the anterior, free portion about two-thirds the length of the basal, interocular part; the apical margin somewhat less emarginate than in the female. Inner orbits twice as far apart on the vertex as at the clypeus. Flagellum very gradually swollen toward the apical half; antennal segments—5 and 6 slightly longer than wide, 7 nearly square, 8 to 12 wider than long; terminal hook as in *E. lucasius*, very slender, almost straight, narrowed from the very base to a long and very

sharp point, which reaches to near the base of the tenth antennal segment. Last sternite normally convex, impunctate, except on the sides before the apex. Clypeus impunctate. The remainder as in the female. Coloration similar, but the clypeus entirely ivory-white ; apical, ivory-white fasciae also on tergites 3 and 4 and on sternites 3 to 6 ; all tibiae with a broader, ivory-white line on the outer surface. In the one specimen seen the ivory-white line is lacking along the posterior margin of the pronotum ; also the third cubital cell is much longer than the second, but this is evidently due to an abnormal shortening of the second cell, as the second recurrent vein ends just beyond the second transverse cubital in the extreme corner of the third cubital cell (in the female described above the second recurrent ends normally in the second cubital cell considerably before the second transverse cubital).

Length (h.+th.+t. 1+2) : 10·5 mm.

Transvaal : Lichtenburg, 1 ♂, January 1, 1906 (H. Brauns).

Natal : Frere, 1 ♀, 1893 (G. Marshall), S.A. Mus.

The two specimens on which the above description is based were identified as *E. acuminatus* by Dr. A. v. Schulthess. The male agrees with de Saussure's very brief description and figure ; the author mentions expressly that the thorax is quite broad at the pronotum, which is one of the main differences of this species with *E. arnoldi* and *E. lucasius*. No complete description of the species has ever been given.

Gribodo (Ann. Mus. Civ. Genova, xxi, 1864, p. 296) described from Abyssinia (Let Marefia, Scioa) the supposed female of *acuminatus*. His description, however, could apply equally well to that species, to *E. arnoldi*, and to *E. lucasius*. According to A. v. Schulthess (Societas Entomol., xxv, 1910, p. 24), Gribodo's *acuminatus* is specifically distinct from de Saussure's species, but the differences were not stated.

H. de Saussure's type (♂), from the " Cape of Good Hope," should be at the Stockholm Museum.

Eumenes capensis, A. v. Schulthess.

Eumenes capensis, A. v. Schulthess, Societas Entomol., xxv, 1910, p. 18 (♀♂). J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, p. 276.

Male and Female.—" Similar to *E. coarctatus*, L., but the thorax less globular, more elongate oval. Petiole (=first abdominal segment)

much longer, as long as the thorax ; parallel-sided in its basal third, then suddenly widening to twice the width, the apical third also parallel-sided, with distinct, median, longitudinal groove ; in profile straight in the basal half, rather strongly swollen and curved in the apical half. Puncturation as in *coarctatus*, coarse and very dense on head and thorax, the intervals smaller than the punctures ; first and second tergites with scattered, fine punctures.

" Black, with abundant orange-red and pale yellow markings. Head and thorax densely covered with long, yellowish-grey pile. The following parts are orange-red : mandibles, labrum, clypeus, a dot between the eyes, the basal half of the antennae as well as their under side, the pronotum (which, however, is blotched with black in the posterior corner), tegulae, scutellum, propodeum, a large spot below the wings, the sides of the first tergite, the hind margin of the second, tergites 3 to 6, and the legs. In addition, on the second tergite a large, median [orange-red] spot (which may be absent), connected with the apical band ; also two large, lateral spots in the anterior half of the tergite, often connected along the sides with the apical band. The following parts are yellow : in the ♀, the postscutellum, a narrow fascia at the apex of the first and second tergites, and stripes on the anterior surface of the tibiae ; in the ♂, the under side of the scape, the prothoracic lobes, the hind margin of the pronotum, two spots on the scutellum, the postscutellum, the lower corners of the propodeum, the apical margin of all tergites and sternites, two small, rounded spots anteriorly on the disk of the second tergite, and the anterior surface of all femora and tibiae.

" Length of body : 16 mm."

Described on one male and two females from " Kapland " (probably Cape Province).

The species is unknown to me. Since it is compared with *E. coarctatus*, we must assume that the hind margin of the second segment is duplicate and that it consequently belongs in *Eumenes* proper. It appears to be quite distinct from any of the species which I have seen, although it does not seem feasible to include it in the key on the strength of published characters. Its closest ally is evidently *E. acuminatus*, but the size (although clearly based upon the total length, which varies considerably with the retraction of the posterior segments) is much too large for that species.

Subgenus Afreumenes, J. Bequaert.

Eumenes melanosoma, H. de Saussure.

The outstanding morphological feature of this species is the presence of a sharp, vertical carina shortly before the *hind* margin of the mesopleura. Although this peculiarity is not mentioned in the description of *E. sulcigastra*, and I have had no occasion to examine the type, I have little doubt that species is the typical colour form of *E. melanosoma*. The various structures pointed out by Gribodo are present in *melanosoma*, which was originally described by error as of Java. As a matter of fact, it has never been found outside the African continent, where it occurs south of 12° N., extending in the west to 12° S., and in the east at least as far as Durban.

The morphological characters of the species have been described and illustrated in my paper of 1918. It may still be added that the apex of the second tergite is not duplicate ; but the punctate, preapical area is separated from the smooth, impunctate, depressed, terminal margin by a fine, transverse, dotted line.

Several colour phases may be recognised. Although the extremes are conspicuously different, there are many intergrades, so that it is not always evident which varietal name to use. Possibly some of the transitional forms may be due to hybridism, as several phases often occur in the same geographical area. They are by no means as clearly defined as in the case of *E. maxillosus*.

Key to Colour Phases of E. melanosoma.

1. Body mainly black, with relatively few ferruginous spots on head, thorax, legs, first abdominal segment, and rarely on the second. Pale yellow or ivory-white markings are either absent or very much reduced. Wings uniformly smoky or dark brown, often with purple reflection 2

   Body black and ferruginous red, more or less abundantly marked with bright yellow. Wings subhyaline or slightly infuscate, with amber-yellow tinge. 4

2. Black, without any yellow or ivory-white markings. Head, thorax, and first segment scantily marked with ferruginous. var. *aterrimus*, A. v. Schulthess

   At least the apex of the first tergite or the propodeum spotted with pale yellow or ivory-white 3

3. Abdomen black with a very narrow, yellowish-white or ivory-white fascia at the apex of the first, or first and second tergites, often interrupted in the middle. Thorax not marked with pale yellow or white.

   typical *E. melanosoma*

   Ivory-white markings more abundant, being present, not only at the apex of the first two tergites, but also on the thorax (at least two spots on pro-

podeum; often also spots on pronotum, scutellum, and postscutellum); head and legs generally marked with pale yellow . var. *decipiens*, Kirby

4. Abdomen without yellow markings or these are reduced to narrow and more or less interrupted fasciae at the apex of the first, or first and second tergites. Propodeum with two yellow spots of variable size; rarely the pronotum, scutellum, and postscutellum also spotted with yellow. Body more or less extensively ferruginous red . . . var. *longirostris*, Gerstaecker

Abdomen, or thorax, or both abundantly marked with yellow . . 5

5. Abdomen, behind the first segment, yellow dorsally, with a black cross over the second tergite . . . . . var. *affinis*, A. v. Schulthess

Abdomen with the yellow markings much less extensive or almost absent. 6

6. Abdomen almost without yellow; usually with two yellow spots near the apical margin of the second tergite. Thorax and head quite richly marked with yellow . . . . . var. *aethiopicus*, H. de Saussure

Most of the abdominal tergites with yellow spots near the apex; often also a yellow spot on each side of the second tergite before the middle.

var. *distinctus*, H. de Saussure

Eumenes melanosoma, typical colour phase.

Eumenes melanosoma, H. de Saussure, Et. Fam. Vesp., i, 1852, p. 61, (♀♂), pl. xii, fig. 1.

Eumenes melanosomus, J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 79 (♀♂) and 281.

Eumenes sulcigastra, Gribodo, Ann. Mus. Civ. Genova, xxi, 1884, p. 295 (♀).

Eumenes sulcigaster, J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, p. 283.

This colour phase is quite widely distributed throughout equatorial Africa, being known from Cameroon (Lolodorf and Batanga, according to specimens in the Carnegie Museum) and Abyssinia (*sulcigastra*, Gribodo) to the Lower Congo (Boma and Malela, in the Congo Museum at Tervueren), Katanga, and Natal. I have seen at the British Museum several specimens collected by S. A. Neave in Uganda (S.-E. Ankole; western shores of Lake Victoria; W. Ankole).

Katanga: Panda River, 2 ♂ and 1 ♀, October 2, 1920, and Kimilolo River, 1 ♀, July 3, 1920 (Mich. Bequaert); Lufire River and 150 to 200 miles west of Kambove (A. A. Neave), Brit. Mus.

Natal: Stella Bush, 1 ♂ (Marley), Natal Mus.; Clairmont, 1 ♂ (Marley); Durban, 2 ♂ (W. Haygarth), 1 ♂ (Ross), 1 ♀ (Marley); Eshowe, 1 ♀ (Marley), S. Afr. Mus.

One of the males of Durban had been identified as *E. melanosoma* var. *longirostris*, and it is evidently an intergrade to that colour phase.

Owing to the total absence of yellow on the thorax, I prefer to include it among typical *melanosoma*. Some specimens have hardly a trace of ferruginous, while others are distinctly blotched with that colour. In the males of Katanga, the clypeus is reddish without pale yellow, in those of Natal it is almost entirely ivory-white.

Eumenes melanosoma var. *aterrimus*, A. v. Schulthess.

Eumenes melanosoma var. *aterrimus*, A. v. Schulthess, Societas Entomol., xxv, 1910, p. 18 (♀). J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 81, 82, and 282 (♀♂).

This extreme melanistic form is so slightly different from the typical phase that it hardly deserves a name. A. v. Schulthess has recorded it from Togo, Cameroon, the Belgian Congo, Nyasaland, and Zanzibar. I have seen at the British Museum numerous specimens from Kenya Colony and the north-western shore of Lake Nyasa (S. A. Neave).

Eumenes melanosoma var. *decipiens*, Kirby.

Eumenes decipiens, W. F. Kirby, Ann. Mag. Nat. Hist., (6), xviii, 1896, p. 265 (no sex).

Eumenes melanosomus var. *decipiens*, J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 81, 82, and 282 (♀♂), figs. 64-69 (on p. 79).

Eumenes gracillima, A. Tullgren, Ark. f. Zool., i, 1904, p. 445, pl. xxiii, fig. 8 (♂).

Eumenes moseri, W. A. Schulz, Spolia Hymenopterologica, 1906, p. 315, figs. 11*a*-11*c* (♀).

Originally described from the Ogowe River, Gaboon, this colour phase appears to be strictly West African. It extends from Sierra Leone, Togo, Cameroon (Metet, Lolodorf, Efulen, and Batanga, at the Carnegie Museum), and Fernando Po (several specimens at the British Museum, including one of the " types " of *E. moseri*), throughout the Belgian Congo (as far south-east as the Manyema), to Uganda (numerous specimens in the British Museum), and Ilala in the Maramas district, Kenya Colony (S. A. Neave, Brit. Mus.).

There are also at the British Museum several specimens from north-east Rhodesia and Mashonaland which are evidently transitional between the typical form and the var. *decipiens*.

Eumenes melanosoma var. *longirostris*, Gerstaecker.

Eumenes longirostris, Gerstaecker, Monatsber. Preuss. Ak. Wiss. Berlin, 1857, p. 462 (♂).

Eumenes melanosomus var. *longirostris*, J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 81, 83, and 282 (♀♂).

Eumenes erythraspis, P. Cameron, Wiss. Ergebn. Schwed. Zool. Exp. Kilimandjaro, ii, 8, 6, 1910, pp. 175 and 179 (♀).

As here understood, this colour phase is typically East African, extending from Kenya Colony (Voi.—Brit. Mus.) to Zululand. Westward it barely enters the north-eastern Belgian Congo (on the Lower Semliki), is more abundant in Upper Katanga, and even reaches Angola (Brit. Mus.).

Katanga: Lubumbashi, 1 ♂, June 3, 1920, and 1 ♀, June 10, 1920 (Mich. Bequaert).

Transvaal: Acornhoek, 1 ♂, November 1918 (R. W. Tucker), S.A. Mus.

Natal: Mfongosi, 1 ♂, March 1916 (W. E. Jones), S.A. Mus.

According to Gerstaecker's original description, *longirostris* is black and ferruginous red, with a yellow spot on each side of the propodeum, a pair of elongate yellow spots behind the middle of the first tergite, a yellow, apical margin on the first tergite, and an interrupted, yellow, transverse fascia at the apex of the second tergite. Among the specimens here referred to *longirostris*, the male from Lubumbashi, Katanga, comes quite near this description, but the interrupted, pale fascia at the apex of the second tergite is exceedingly narrow; the clypeus is totally yellow. The female from the same locality is quite similar, but has a reddish-brown clypeus, and the second tergite lacks the apical fascia. In the male of Acornhoek there is a small, yellow spot on each side of the pronotum; while the male of Mfongosi has, in addition, two yellow dots on the scutellum, an interrupted, yellow band on the postscutellum, and traces of preapical, lateral, yellow spots on tergites 3, 4, and 5.

Eumenes melanosoma var. *affinis*, A. v. Schulthess.

Eumenes melanosoma var. *affinis*, A. v. Schulthess, Societas Entomol., xxv, 1910, p. 18 (♀♂). J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 81 and 282.

Eumenes xanthaspis, P. Cameron, Wiss. Ergebn. Schwed. Zool. Exp. Kilimandjaro, ii, 8, 6, 1910, p. 175 (♂).

In coloration this interesting form is a perfect mimic of the typical colour phase of *E. lepeleterii*. It is apparently quite rare and peculiar to the coastal districts of equatorial East Africa. A. v. Schulthess' specimens were from Daressalaam, while *E. xanthaspis* was described from Kibonoto, on the lower slopes of Mt. Kilimanjaro. At the United States National Museum I have seen a male from Jombene Hills, Kenya Colony (Chanler-Hohnel Expedition), which is here somewhat more fully described.

Black, with abundant bright yellow markings as follows : clypeus ; mandibles ; a lozenge-shaped spot between the antennae ; sinus of eyes ; outer orbits ; scape quite broadly below ; pronotum (except for a black, triangular spot on each side before the wings) ; scutellum (except posteriorly) ; major part of mesopleura ; propodeum (except for a black stripe on the median groove) ; outer side of fore femora, of all tibiae, and of fore and middle basitarsi ; an elongate spot on each side beyond the middle and a narrow apical margin on first abdominal tergite ; broad, preapical bands on tergites 2 to 5, interrupted in the middle ; also a broad, somewhat triangular spot on each side in the basal half of second tergite ; and small, lateral spots on sixth tergite. Major part of antennae, anterior face of thorax, tegulae, legs (except where yellow), sides of first abdominal segment (more extensively before the yellow, apical margin), sides of second tergite, and all the sternites, more or less ferruginous ; this colour also suffuses the black of the pleura. Wings subhyaline, tinged with amber yellow.

Length (h.+th.+t. 1+2) : 13 mm.

Another male from Kibwezi, Kenya Colony, 3000 ft., April 2–4, 1911 (S. A. Neave), is coloured exactly like the Jombene specimen.

Eumenes melanosoma var. *aethiopicus*, H. de Saussure.

Eumenes aethiopica, H. de Saussure, Et. Fam. Vesp., i, 1852, p. 62 (♀).
Eumenes melanosoma var. *aethiopicus*, J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 81, 84, and 281 (♀♂).

This form appears to be restricted to the West African subregion. I have seen the type, of the Congo, at the British Museum, which also contains additional specimens from Sierra Leone, the Gold Coast, Northern Nigeria, and Uganda. It has been reported from the Gaboon, and it is quite widely distributed in the Belgian Congo (apparently not in Upper Katanga). At the Carnegie Museum, Pittsburgh, there is a female from Olama, Cameroon.

Eumenes melanosoma var. *distinctus*, H. de Saussure.

Eumenes distinctus, H. de Saussure, Et. Fam. Vesp., iii, 1856, p. 143 (♂).

Eumenes melanosoma var. *distinctus*, J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 82. 84, and 282 (♀♂).

Eumenes walkeri, C. Ritsema, Tijdschr. v. Entom., xvii, 1874, p. 199, pl. xi, fig. 7 (♂).

This colour phase has much the same distribution as the var. *aethiopicus*. I have seen it at the British Museum from Sierra Leone, Northern Nigeria, and Uganda. It is common in the Belgian Congo, where it even enters Upper Katanga. Possibly it might be found in Rhodesia.

Katanga: Lubumbashi, several ♀ and ♂, June and July 1920 (Mich. Bequaert).

The yellow markings are quite variable in extent, and some specimens appear to be intergrades between this and the var. *aethiopicus*.

Subgenus Delta, H. de Saussure.

Eumenes phthisicus, Gerstaecker.

(Text-figure 9.)

Eumenes phthisicus, Gerstaecker, Monatsb. Preuss. Ak. Wiss. Berlin, 1857, p. 463 (♂); in Peters, Reise n. Mossambique, Zool., v, 1862, p. 463, pl. xxx, fig. 2 (♂). J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, p. 283.

This species has not yet been fully described. Gerstaecker knew only the male, and his description is incomplete in several important particulars, such as the shape of the antennal hook. The female is, so far as I know, undescribed.

Female (undescribed).—Head rather flattened, seen in front slightly wider than high. Clypeus a little longer than wide, elongate hexagonal, very slightly and evenly convex; the anterior, free portion nearly as long as the basal, interocular part; the apical margin about one-half the total width of the clypeus, very broadly and arcuately emarginate, with distinct and rather sharp edges. Vertex without fovea. Ocelli placed in a flattened triangle; the posterior ocelli distinctly farther apart than from the inner orbits, about as far from the hind margin of the vertex as from the eyes; anterior ocellus a little larger. Front

slightly raised and very bluntly carinate between the antennae. Eyes bare, but slightly farther apart on the vertex than at the clypeus. Vertex and temples quite narrow, margined behind with a continuous, sharp rim. The shape of the mandibles is characteristic; they are moderately long and slender, decussate, straight, slightly curved at the blunt apex, with three narrow notches along the inner margin; of the three teeth thus defined, the first (nearest the base, but placed about midway) is small and blunt; the two following are very broad, flattened plates, the second being about twice as long as the third; beyond the third, the inner margin forms a much narrower plate extending to near the apex; the inner margin is set off by a carina accompanied by a deep groove, which bears numerous stiff setae; shortly before the apex the setae are so numerous as to form a brush; owing to the development of the lamellar teeth, and also to a slight widening of the outer margin, the mandible is nearly as broad in its apical half as at the base. Third segment of maxillary palpi short, only half as long as the second, and about the length of the fourth and fifth. Antennae rather short, moderately swollen toward the apical half; segments—6 and 7 longer than wide, 8 almost square, 9 to 11 slightly wider than long, 12 a little longer than wide at base. Thorax elongate globular, nearly subglobular, shorter and more convex than in the other Ethiopian species of the subgenus *Delta*; but little longer than high in profile or than broad seen from above. Pronotum squarely truncate; the anterior margin rimmed throughout with a fine, raised line; on the sides, below the humeral angles, there is at first only a blunt ridge, but in the lower part this becomes a wavy carina. Humeral angles broadly rounded off, the pronotum but little narrowed anteriorly. Mesonotum slightly longer than wide, with a fine, median, impressed line in its anterior half, generally hidden under the appressed pilosity. Scutellum and postscutellum evenly and slightly convex, forming a continuous curve with the mesonotum; the scutellum partly and the postscutellum entirely within the posterior slope of the thorax; neither of them show a median raised line or depression. Propodeum very short and moderately convex; seen from above hardly longer than postscutellum, rounded off, without ridges or projecting angles on the sides; in the upper half it is merely divided by a fine, median, longitudinal, impressed line; in the lower half it is very broadly and shallowly excavated toward the base of the abdomen; just above the valvulae the sides are conspicuously compressed into a short ridge, ending posteriorly in a sharp point. Mesopleura without carinae along the anterior and posterior epicnemial

depressions, which are, however, quite pronounced. Legs slender, as usual. Venation of wings of the ordinary *Eumenes* type; the third cubital cell rather longer at the cubital vein than usual. First abdominal segment very long and slender, more so than in the other African species of the subgenus *Delta*; nearly as long as head and thorax in profile; about five times as long as wide at apex, seen from above; in profile strongly curved and quite gradually and slightly swollen from the base to before the apex; seen from above it very gently widens posteriorly (even more evenly than in *E. lepeleterii*), the apex being not much over twice the width of the base; dorsally it is uniformly convex, without any trace of groove; the spiracles are not in

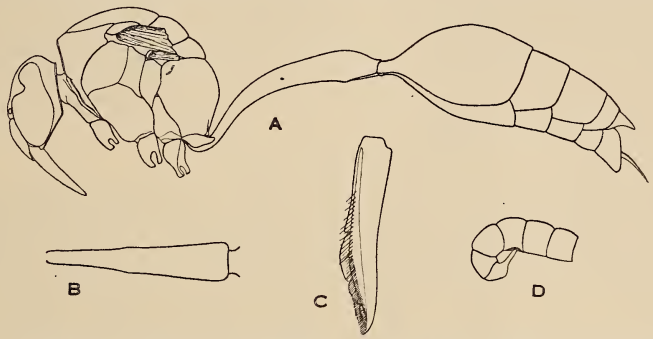

Fig. 9.—*Eumenes phthisicus*, Gerstaecker. *A*, female in profile; *B*, first tergite of female from above; *C*, mandible of female; *D*, terminal segments of male antenna.

the least visible from above, and they are just barely raised on the sides. Second segment elongate oval and slightly depressed, about equally convex dorsally and ventrally, nearly one and one-half times as long as high in profile, and but little longer than wide seen from above; basal neck long, a little over half as wide as the apex of the first segment, as conspicuous as in many species of *Zethus*; apical margin simple, depressed; sternite more convex than usual, slightly flattened at base. Head and thorax quite densely covered with large but rather shallow punctures, giving it a minutely reticulate appearance; vertex, temples, tegulae, and epicnemial depressions for the fore and middle legs nearly impunctate; the sides of the propodeum also with rather sparse and small punctures; the anterior margin of the scutellum with a smooth area, which extends somewhat backward in the middle; clypeus with few, very scattered, small punctures, which are somewhat more distinct in the basal half. Abdomen impunctate under an ordinary lens; but under high magnification it

is densely and uniformly covered with microscopic punctures. Head and thorax densely covered with short, greyish-white, somewhat matted pile, with a slight silvery sheen, more noticeable on the clypeus; abdomen and legs nearly bare, with a faint greyish bloom.

Black, with indefinite ferruginous brown blotches on mandibles, base and under side of antennae, clypeus, pronotum, tegulae, pleura, scutellum, propodeum, sides of first abdominal segment, base of second, succeeding sternites, last tergite, and legs. The ivory-white markings are reduced to a short line along the outer orbits above, two small spots before the apex and a narrow line on each side of the apical margin on the first tergite, and a quite narrow preapical fascia on the second tergite, generally interrupted in the middle. Wings faintly smoky anteriorly, somewhat brownish in the costal cell, the radial cell more purplish. The extent of the ferruginous and ivory-white markings varies, not two of the five females which I have seen being alike in this respect.

Length (h.+th.+t. 1+2): 14·5 to 16 mm.

Male.—Clypeus much longer than wide; the anterior, free portion distinctly longer than the basal, interocular part; the apical margin about one-half the total width of the clypeus, broadly and arcuately emarginate, with sharp edges. Posterior ocelli about twice as far apart as from the inner orbits. Eyes a little less than twice as far apart on the vertex as at the clypeus. Mandibles of more usual shape; the lamellar teeth along the inner margin much narrower than in the female; the conspicuous row of setae and preapical brush absent. Antennae moderately and quite gently swollen toward apical half; segments—7 and 8 slightly longer than wide, 9 and 10 nearly square, 11 and 12 longer than wide; last, hook-like segment hunchbacked, shaped like a duck's head in profile: the basal half much swollen, the apical part very abruptly narrowed to a blunt point, which fits in a shallow pit at the under side and about the middle of the tenth segment. Last abdominal sternite uniformly convex, smooth, impunctate. Clypeus either ferruginous and black as in female, or more or less broadly margined with ivory-white; the inner orbits narrowly ivory-white from the clypeus to the bottom of the ocular sinus. In one of the males from Zululand there is a narrow ivory-white line along the posterior margin of the post-scutellum. The remainder as in the female.

Length (h.+th.+t. 1+2): 12 to 15 mm.

E. phthisicus, originally described from Mosambique, has been but rarely recorded since. Schouteden (Rev. Zool. Afric., vi, 1919, p. 175)

reports it from Katanga (between Kayambo and Dikulwe—S. A. Neave), upon the strength of a specimen named by R. de Buysson. It is, however, not restricted to East Africa. There are at the Carnegie Museum, Pittsburgh, several females from Cameroon (Bipindi, Efulen, and Lolodorf—H. L. Weber and A. I. Good).

Southern Rhodesia: Bulawayo, 1 ♀, April 23, 1912 (G. Arnold), Rhodesia Mus.; Bindura, 1 ♀ (D. Coghill), S.A. Mus.; Salisbury, 1 ♂, April 1900 (G. K. Marshall).

Portuguese East Africa: Lourenco Marques, several ♀ and ♂ (H. Junod).

Natal: Stella Bush, 1 ♀, January 1915 (Marley); Mfongosi, 2 ♂, May 1916 (W. E. Jones), S.A. Mus.

Dr. H. Brauns has communicated a male, said to have been compared with Gerstaecker's type by Dr. A. v. Schulthess.

Eumenes caffer (Linnaeus).

(Text-figure 10.)

Vespa caffra, Linnaeus, Syst. Nat., 12th ed., i, 2, 1767, p. 951 (no sex).
Eumenes caffra, H. de Saussure, Et. Fam. Vesp., i, 1852, p. 45 (♀). J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, p. 275 (in part; not pp. 69 and 72).
Sphex cruciata, Christ, Naturgesch. d. Insecten, 1791, p. 317, pl. xxxii, fig. 2.
Vespa cratiata, Lichtenstein, Catalogus Mus. Zool. Hamburgi, 1796, iii, Insecta, p. 202.
Sphex crucigera, Weber, Observ. Entomol., 1801, p. 101.

In my Revision of the Vespidae of the Belgian Congo, I had reached the conclusion that *E. caffer* (Linnaeus) was not morphologically distinct from *E. campaniformis* (Fabricius), and I regarded *E. formosa*, H. de Saussure, as identical with *E. caffer*. Unfortunately I was unable at the time to examine South African specimens of *caffer*. I have since found that the true *E. caffer* of the Cape differs in a number of important particulars from the several colour phases of *E. campaniformis*. The description and drawings which I gave in 1918 of the morphology of *E. caffer* do not apply to that species, but to *E. campaniformis* (Fabricius). It is therefore necessary to point out the structural peculiarities of *E. caffer*.

Female.—Head seen in front but little broader than high. Clypeus about as long as wide, elongate hexagonal; its apical, free portion slightly shorter than the basal, interocular part; its apical margin

straight, with bluntly rounded edges. Ocelli in a flattened triangle, the posterior ocelli a little farther apart than from the inner orbits, about as far from the hind margin of the vertex as from the eyes. Antennae moderately swollen ; segments—7 and 8 nearly square, 9 to 11 wider than long, 12 about as long as wide at base. Thorax elongate oval, about one-third longer than high, somewhat longer than in *E. campaniformis* ; the mesonotum conspicuously longer than wide.

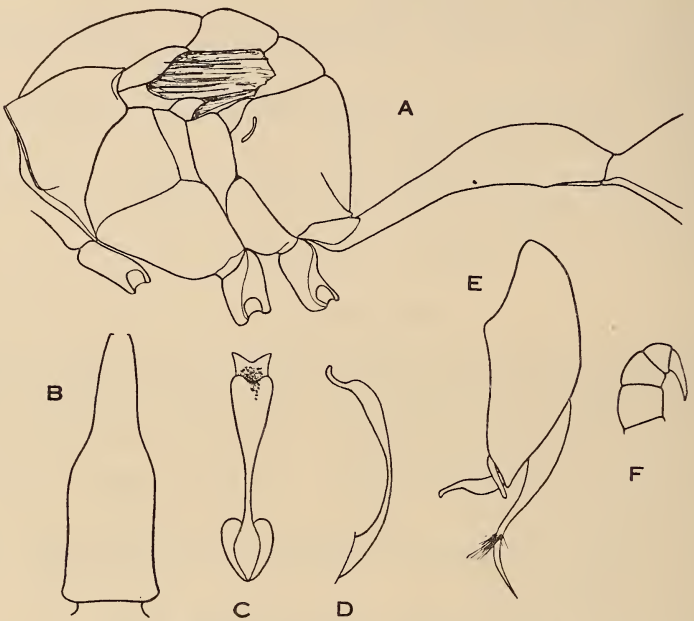

Fig. 10.—*Eumenes caffer* (Linnaeus). *A*, thorax and first tergite of female in profile ; *B*, first tergite of female from above ; *C*, penis from above ; *D*, penis in profile ; *E*, male genitalia in profile, outer view ; *F*, terminal segments of male antenna.

First abdominal segment distinctly shorter than the thorax ; its general shape as in *campaniformis*, but of stouter build ; in profile its apical half is relatively more swollen as compared with the base ; seen from above its apical, widened portion is not quite twice as long as its greatest width and is parallel-sided, so that the passage to the basal stalk is much more abrupt than in *campaniformis*. The broadened part of the first tergite bears a few scattered, but distinct punctures ; whereas in *campaniformis* it is almost impunctate, with very few, quite minute punctures. Second sternite normally convex. The hind tarsi are about as long as the hind femur and trochanter, but much longer than the tibia. The few differences from *E. campani-*

formis are slight and of degree only, and, were it not for the striking characters presented by the male antennae and genitalia, one would never feel quite certain of the specific distinction of the two forms.

The maxillary and labial palpi are more slender in *E. caffer* than in *E. campaniformis*; this is especially striking for the three basal segments of the maxillary palpi, whose third segment is decidedly longer than the three apical segments together.

Male.—The difference in the shape of the thorax also holds good in this sex; but it is much less evident in the shape of the first abdominal segment, which is more slender than in the female. The antennal hook is slender, gradually tapering from a triangular base to a long, very sharp, straight apex, reaching to slightly beyond the middle of the tenth antennal segment; there is, however, no pit or excavation of that segment to receive it. The antennal hook is in general outline more like that of *E. lepeleterii* than *E. campaniformis*, though somewhat more pointed than in the former. Gribodo (Mem. Ac. Sci. Bologna, Sc. Nat., (5), v, 2, 1895, p. 90) has correctly described it. The male genitalia are strikingly dissimilar from those of *E. campaniformis*, *E. lepeleterii*, and *E. maxillosus*, which is the more remarkable since they are so much alike in the three last-named species. The whole organ is quite thick and bulky, very wide seen in profile; the penis is conspicuously narrowed beyond the swollen base into a slender stalk and widens again into a terminal, long and broad, more or less saddle-shaped plate, which is deeply emarginate at the apex.

Length (h.+th.+t. 1+2): ♀, 19 to 20 mm.; ♂, 13 to 18 mm. The male is unusually stout in this species.

E. caffer appears to be restricted to South Africa; with the exception of Potchefstroom, all the localities from which I have seen it are south of the Orange and Vaal Rivers. R. du Buysson (Bull. Soc. Ent. France, 1908, p. 134; in A. Chevalier, L'Afrique Centrale Française, 1908, p. 707; and Act. Soc. Linn. Bordeaux, lxiv, 1910, p. 228) has recorded it from the Atlantic coast of the Sahara as well as from the central Sahara (Oued Tidek; valley of Taghazi, north of the Air); but I have little doubt that the specimens in question were misidentified. Most probably they belonged to some colour phase of *E. arbustorum* (Panzer).

I have seen specimens from the following localities :—

Transvaal: Potchefstroom, 1 ♀ (T. Ayres); S.A. Mus.

Orange Free State: Smithfield, 1 ♀ and 1 ♂ (Kannemeyer), S.A. Mus.

Cape Province: East London, 1 ♀ (J. Wood); O'okiep, 1 ♀,

September 1890 (P.M.L.); Henkries, Bushmanland, 1 ♂, October 1911 (Lightfoot); Jackals Water, Bushmanland, 1 ♂, October 1911 (Lightfoot)—all in S.A. Mus.; Ceres and Witzenburg Valley, 3500 feet, Ceres district (R. E. Turner), Brit. Mus.; Willowmore, 1 ♀ and 1 ♂ (H. Brauns).

In coloration *E. caffer* appears to vary but little. It is black with the following bright yellow markings: clypeus (in both sexes); the centre of the face between the antennae; the inner orbits from the clypeus to half-way in the sinus of the eyes; basal half of mandibles, gradually fading into the ferruginous apex; under side of scape; a narrow line along the outer orbits in the upper part of the temples; pronotum; upper plate of mesopleura, continuous with a large, triangular spot on the lower plate; a very wide band across the scutellum; postscutellum except anteriorly; propodeum except for a broad, median stripe; posterior half of tegulae; four spots on the swollen portion of the first tergite, two above the spiracular protuberances and two before the apex extending laterally to the edges, but not connected medially; the remainder of the abdomen, except for an elongate, median, black spot on the basal half of the second sternite (drawn out into a point posteriorly) and a black cross over the second tergite, the cross gradually narrowing and fading away on the succeeding tergites; an elongate spot on middle coxae; the under side of fore and middle femora; the upper side of all tibiae and of fore and middle basitarsi. The apex of mandibles, the basal half of the flagellum and a line on the under side of its apical half, the under side of the broader, apical half of the first segment, the sides of second tergite and sternite near the base, and the legs wherever not yellow, are ferruginous red. The wings are subhyaline, with a yellow, amber-coloured tinge and a slight, purplish black spot in the radial cell. The two sexes are coloured almost exactly alike.

It is possible that there exists in the coastal region of the Cape Province a colour phase of *E. caffer* similar to *E. campaniformis* var. *pulcherrimus*. See the discussion of that form, p. 551.

Eumenes campaniformis (Fabricius).

(Text-figure 11.)

The structural characters of this species have been described and illustrated in my Revision of the Vespidae of the Belgian Congo (1918), under the heading *E. caffer* (p. 69, figs. 50–55). It was believed at the time that *caffer* and *campaniformis* were but two colour phases

of the same species. They are, however, morphologically quite distinct, as I have shown above.

As *E. campaniformis* assumes several colour phases, some of which are deceivingly similar to forms of other species, its chief characters may be pointed out. In the female the head as seen in front is nearly one-fifth broader than high ; the eyes are but little farther apart on the vertex than at the clypeus ; the posterior ocelli are much less than twice as far apart as from the inner orbits ; the sides of the propodeum are completely rounded off between the dorsal and the ventral areas ; the first abdominal segment is intermediate in shape between that of *E. maxillosus* and *E. lepeletterii* ; it approaches that of the former, though it is more slender, being about as long as the thorax ; seen from above it is distinctly divided into a basal, stalk-like half and an apical, broader portion, both with subparallel sides and the passage between the two rather abrupt ; the apex does not widen out as in *E. maxillosus*, and is about one-fourth of the total length of the segment ; second sternite normally convex in the centre. The hind tarsi are about as long as the hind femur and trochanter. In the male the first segment is somewhat more slender ; the hook-like segment of the antennae approaches that of *E. maxillosus*, being in profile slightly thickened beyond the apex ; but seen from above it is not widened in its apical half ; it is rather abruptly and sharply pointed at the apex, which rests in a small excavation on the under side, near the extremity of the tenth antennal segment ; the eyes are distinctly nearer at the clypeus than on the vertex, and the posterior ocelli are about twice as far apart as from the inner orbits. An examination of much additional material has convinced me that the difference in the female antennae, which I had formerly relied upon, is imaginary. Neither is there any reliable difference in the development of the groove-like depression of the last abdominal sternite in the male.

E. campaniformis and its several colour phases have a wide range over the Ethiopian, Oriental, Malayan, and Papuan regions, as far as Mesopotamia, southern China, Formosa, New Guinea, the Solomon Islands, and Queensland. In Africa it is known with certainty from Lower Egypt and the Senegal River to Angola in the west, and to the Orange Free State and Natal in the east. It is seemingly absent from the Cape Province, where it appears to be replaced by *E. caffer*, although the ranges of the two species overlap in the Orange Free State and southern Transvaal (see the map in my paper of 1918, p. 71, which should, however, be amended to cover the whole of

Egypt, Mesopotamia, and southern Persia, and to exclude south-western Africa and the Cape Province). It is not known from the Malagasy region.

If we regard *campaniformis* and *esuriens* as mere colour phases of one morphological type, the specific name should be *campaniformis*, which is much older than *esuriens*.

My former treatment of the colour phases of *E. campaniformis* (1918) was wholly inadequate, owing to the restricted material of which I disposed and to my erroneous interpretation of *E. caffer* (Linnaeus). The morphological species *campaniformis* evidently presents many

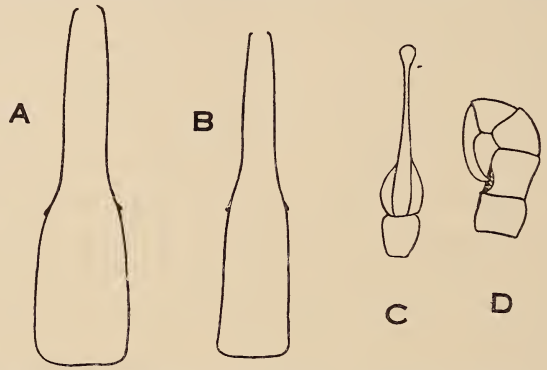

Fig. 11.—*Eumenes campaniformis* (Fabricius). *A*, first tergite of female from above ; *B*, first tergite of male from above ; *C*, penis from above ; *D*, terminal segments of male antenna.

colour phases, the study of which is fully as interesting as those of *E. maxillosus*. Since several of them occur in South Africa, I have thought it appropriate to present a revision of all the variations. As indicated below, there are probably a number of additional colour phases worthy of recognition, but as I have generally not seen them, they are left nameless for the present. There is always a possibility that the types might prove to be morphologically distinct from *E. campaniformis*. Moreover, the distribution of the several colour phases of *E. campaniformis* can hardly be worked out at present : they have been too frequently confused with one another and with similar colour variations of allied species (especially *E. lepeleterii*).

Key to Colour Phases of E. campaniformis.

1. Mostly black, with a few dark ferruginous markings on head, thorax, legs, and first two abdominal segments. Clypeus and spots on head yellow ; rarely the pronotum somewhat yellowish along anterior margin.

var. *pseudodyscherus*, J. Bequaert

More extensively ferruginous or ferruginous and yellow; at least the posterior abdominal segments marked with yellow or orange 2

2. Thorax extensively ferruginous, but with no or very little yellow. First abdominal tergite extensively and second at base ferruginous. The posterior abdominal tergites margined with orange (usually also the extreme apical corners of second tergite) . . . var. *rendalli*, Bingham

Thorax and abdomen abundantly marked with yellow 3

3. Abdomen almost entirely yellow; first segment extensively ferruginous, with a black, preapical spot separating two yellow, elongate markings; the second tergite with a narrow, spear-shaped black mark, extending from the base to beyond the middle . . . var. *rhodesiensis*, J. Bequaert

Second tergite of the abdomen with a black cross, or a black transverse band. 4

4. Apex of second tergite with a broad, continuous, yellow band, which is at most faintly notched in the middle 5

Apical yellow band of second tergite broadly interrupted by black medially. 7

5. Thorax mostly yellow and ferruginous, the mesonotum often with black spots; base of second tergite ferruginous, separated by a narrow, black fascia from the wide, yellow, apical third . . . . var. *esuriens* (Fabricius)

Thorax mostly black and yellow, the mesonotum either entirely black or with a small russet spot; the transverse, black fascia of second tergite broad. 6

6. Basal third of second tergite ferruginous, with or without small, yellow spots. Scutellum and propodeum often more or less ferruginous.

var. *gracilis*, H. de Saussure

Basal third of second tergite mostly yellow, but divided by a longitudinal, median, black line or band. Thorax with little or no ferruginous.

typical *campaniformis* (Fabricius)

7. Second tergite with extensive yellow spots at the base, the black forming a distinct cross over the abdomen . . var. *formosus*, H. de Saussure

Second tergite more or less ferruginous at base, the black more extensive and not forming a cross over the abdomen.

var. *marshalli*, J. Bequaert (? = *pulcherrimus*, A. v. Schulthess)

Eumenes campaniformis, typical colour phase.

Vespa campaniformis, Fabricius, Syst. Entom., 1775, p. 371 (no sex).

Eumenes campaniformis, H. de Saussure, Et. Fam. Vesp., i, 1852, p. 55 (♀).

Eumenes esuriens var. *campaniformis*, R. du Buysson, Abh. Senckenberg. Naturf. Ges., xxxiv, 2, 1911, p. 230.

Eumenes tricolor, P. Cameron, Nova Guinea, v, Zool., 1, 1906, p. 64 (♀) (not of F. Smith, 1860). See Meade Waldo, Ann. Mag. Nat. Hist., (8), xiv, 1914, p. 404.

The name *campaniformis* was originally proposed by Fabricius for a wasp of Australia, described as follows: "Black, variegated with yellow; petiole of the abdomen ferruginous, black at apex and with two yellow spots. A little smaller than the preceding species [i.e.

E. arcuata]. Antennae ferruginous, brownish at apex. Head black, the front and the orbits of eyes yellow. Tongue ferruginous. Thorax black; the anterior lobe, a large spot below the wings, and a small dot before the wings, yellow. Scutellum yellow, with a black band. Thorax below the scutellum yellow, with a black median groove. Petiole of abdomen elongate, curved, ferruginous, black at apex, on either side with a yellow dot. Second segment the largest, with two basal spots and the margin yellow. Remaining segments with yellow margin. Legs yellow." The type is in the Banks Collection, at the British Museum.

Typical *campaniformis* differs but little from the var. *esuriens*. The most important point is that the ferruginous base of the second tergite is extensively or completely replaced by yellow; generally, too, the transverse black band of the second tergite is broader and connected on the middle line with the base of the tergite (so as to form a black inverted T); while the yellow apical band of the first tergite is interrupted in the middle, the ferruginous colour is much reduced on the thorax, being replaced either by black or by yellow.

Length (h.+th.+t. 1+2): ♀, 15 to 17 mm.; ♂, 14·5 mm.

This colour phase is found in the Malayan and Australian regions. I have seen it from Java, the Philippine Islands, Queensland, and Yule Island, near New Guinea.

E. urvillei, de Saussure (Et. Fam. Vesp., i, 1852, p. 59, ♀♂), appears to have been based upon two distinct colour forms. The male of Triton Bay, on the coast of New Guinea, evidently does not differ from typical *E. campaniformis*. The female of Banda Island, however, is said to have the second tergite entirely ferruginous at base, without yellow spots, but with a broad yellow apical band, interrupted in the middle; the mesonotum is black and the propodeum spotted with ferruginous and yellow; there are some other points, too, which seem to indicate that this may represent a peculiar colour phase worthy of recognition. The absence of yellow spots at the base of the second tergite excludes *E. edwardsii*, H. de Saussure. I have, however, as yet seen no specimens agreeing with the description. The types of *E. urvillei* should be at the Paris Museum.

Eumenes campaniformis var. *esuriens* (Fabricius).

Vespa esuriens, Fabricius, Mantissa Insect., i, 1787, p. 283 (no sex).
Eumenes esuriens, H. de Saussure, Et. Fam. Vesp., i, 1852, p. 56, pl. xi, fig. 2 (♀♂). R. du Buysson, Abh. Senckenberg. Naturf. Ges., xxxiv, 2, 1911, p. 230 (in part).

Eumenes caffer var. *esuriens*, J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, p. 275 (♀♂) (in part) (not p. 73).

Vespa pediculata, Olivier, Encycl. Méthod. Hist. Nat., Ins., vi, 1791, p. 671 (no sex).

Eumenes boscii, H. de Saussure, Et. Fam. Vesp., iii, 1856, p. 132 (MS. name, as a synonym of *E. esuriens*).

This was first described by Fabricius from India, in the following terms (so far as coloration is concerned) : " Ferruginous, with yellow abdomen ; the curved petiole and first segment ferruginous, the former with yellow margin, the latter with black margin. Head yellow ; the antennae ferruginous with brown apex. Thorax yellow, the dorsum and hind part ferruginous. Scutellum yellow. Petiole of the abdomen ferruginous, yellow at the apex and slightly black before the apex. Second segment ferruginous, with black margin ; the remainder yellow. Wings darkened. Legs yellow, with ferruginous femora." There are some evident errors in this description : the statement that the second segment has a black margin is undoubtedly due to an oversight, as the black band runs over the middle of the tergite. If one allows for this, de Saussure's interpretation of *esuriens* is quite correct (his figure, however, is misleading and does not agree with the description in several important particulars), and I have seen specimens of both sexes, from India (Bombay, Abu, etc.), which have this coloration. They may be described as follows :—

Mostly yellow and ferruginous-red ; the black being restricted to a broad band across the vertex (including the ocelli), a narrower band on the occiput and outer part of the temples, an anterior and two lateral spots on the mesonotum, propleura, the base of the first segment, and a black, transverse band before its apex dorsally, a transverse band about the middle of the second tergite, the base of the succeeding tergites and apex of the last, and the apical two-thirds of the middle and hind tarsi ; the apical half of the flagellum is brownish on the upper side. The following parts are ferruginous : major part of antennae (the scape yellow beneath), apex of mandibles, mesonotum (except for the black spots and hind margin), scutellum, tegulae, sternum, metapleura, and propodeum (the propodeum dorsally with a small yellow spot on each side, close behind the wings), first segment (except for the black base and preapical band and the broad, yellow apex dorsally), the basal half of the second segment, the legs (except for the black, apical two-thirds of the middle and hind tarsi, and much yellow on the tibiae and on the upper side of the anterior femora). All other parts of the body yellow, and the posterior part

of the second tergite is continuously so, without black division or interruption in the middle. There are no yellow spots on the ferruginous base of the second tergite. The wings are subhyaline, with amber-yellow tinge and with a darker, somewhat purplish spot in the radial cell.

The var. *esuriens* appears to be restricted to India proper, but it has been so commonly confused with the var. *gracilis* and typical *campaniformis* that its distribution cannot be correctly given. I have never seen it from the African continent. What I had recorded as *esuriens* from the Belgian Congo (Stanleyville and Bogoro) (Bull. Amer. Mus. Nat. Hist., xxxix, 1918, p. 73) does not belong to the typical colour phase, but is described in the sequel as var. *marshalli*.

The specimens described by H. de Saussure (Et. Fam. Vesp., i, 1852, pp. 56 and 57) as *E. esuriens* var. B and var. C, in which the mesonotum is spotted with yellow or is almost completely yellow, probably represent a colour phase worthy of a varietal name. As I have seen no such specimens as yet, I refrain from naming it. The variety C is stated to have come from Persia ; it is quite possible that all Persian, and perhaps Mesopotamian, specimens are of that type.

Eumenes campaniformis var. *gracilis*, H. de Saussure.

Eumenes gracilis, H. de Saussure, Et. Fam. Vesp., i, 1852, p. 57 (♀♂).
Bingham, Fauna of Brit. India, Hym., i, 1897, p. 343, fig. 97 (♀♂).
Eumenes esuriens var. *gracilis*, H. de Saussure, Et. Fam. Vesp., iii, 1856, p. 132 (♀♂).
Eumenes caffer var. *gracilis*, J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, p. 275 (not p. 72).

This form was originally described from Egypt and the Senegal (types in the Paris Museum) in the following terms : " Female.—Very close to *E. esuriens* as well in size as in coloration. Head black ; hind margin of the eyes, front, sinus of the eyes, and clypeus yellow, the clypeus a little emarginate. Antennae ferruginous, with a black spot near the apex. Prothorax yellow, as is also a large spot beneath the wing, separated from the yellow prothorax by but a narrow, black line. Mesonotum black, with a small, bifurcate, russet spot anteriorly, Tegulae and scutellum russet. Postscutellum yellow. Propodeum yellow, divided by a russet band. Pleura russet and black. Petiole [=first abdominal segment] ferruginous, with black base, ending in two yellow spots which are preceded by a black band. Second abdominal segment ferruginous at base, ornamented with a black

band over the middle, and with two yellow dots on the ferruginous part, the remainder yellow; the succeeding segments yellow, with black base; as a rule the yellow only is visible. Anus ferruginous. Under side of the abdomen russet, the segments margined with yellow, and a lozenge-shaped black spot, often indistinct, on the second sternite. Legs ferruginous, the tip of the tibiae yellow, as are also nearly the whole fore pair of legs. Wings ferruginous along the costa; veins ferruginous or brown; a brown spot in the radial cell. Male.—Clypeus without emargination. The first segment and the apex of the antennae black on the upper side, except on the two last segments. Mesothorax entirely black. The yellow margins of the abdominal segments narrower than in the female, so that the black base is distinct. Anus black. Legs spotted with black. The remainder as in the female." The author also notes variations of the female, in which the yellow spots of the second abdominal segment are absent, the base of this segment is black, and the stripe which divides the propodeum is also black; mesonotum entirely black; the black band of the second abdominal segment widened in the middle; the two yellow spots of the petiole fused into an apical band. There is a corresponding variety of the male without yellow spots on the second segment. In addition, de Saussure quotes Savigny, Descript. de l'Egypte, Atlas, Zool., Ins. Hym., 1812, pl. viii, fig. 6 (♀♂), as representing *gracilis*.

I have quoted this description at length because it clearly shows that the name *gracilis* should be used for a colour phase which merely differs, as de Saussure states, from the var. *esuriens* "in the mesonotum being entirely black or with but a small russet spot, in the black bands of the abdomen being broader and darker, and in the black spot of the antennae." There may or may not be two small yellow spots on the ferruginous base of the second tergite. R. du Buysson (Abh. Senckenberg. Naturf. Ges., xxxiv, 2, 1911, p. 230) seems to imply that the var. *gracilis* is strictly African (Egypt, Senegal, Congo, Sudan, etc.), whereas it really is the more common form in southern Asia. I have seen specimens which agree well with de Saussure's account, from Lower Siam (United States National Museum), Mombasa, Kenya Colony (G. M. Allen and G. Brooks—Mus. Comp. Zool., Cambridge), Fayum, Egypt, and Formosa. It is at present impossible to accurately define the area over which *gracilis* is found on the African continent. I have not seen it from the Belgian Congo; all the specimens I had referred to *gracilis* in Bull. Amer. Mus. Nat. Hist., xxxix, 1918, p. 72, belong to the var. *rendalli*, Bingham.

Eumenes elegans, H. de Saussure, Et. Fam. Vesp., i, 1852, p. 58 (♀), pl. xi, figs. 3 and 3*a*, was described from Djidda, Arabia, and the East Indies (in the Paris Museum) as follows: "Yellow with the vertex, mesothorax, and a band on the second segment of the abdomen, black. Wings brown. Female: length, 20 mm.; spread of wings, 38 mm. Head broad, ferruginous, darkened on the upper side toward apex; under side of the head, and even the sinus of eyes, very villose. Thorax villose, ferruginous; mesothorax [=mesonotum] black. Petiole [=first abdominal segment] ferruginous, black at base, its hind angles yellow. Abdomen ferruginous; the second segment margined with yellow and with a broad black band gradually passing into the ferruginous; under side of the segments darkened. Legs ferruginous. Wings hyaline, ferruginous at the base, brown with violet reflections in their external two-thirds. This pretty species much resembles *E. esuriens* and allied species, but is easily distinguished by the strongly smoky wings, which are somewhat violaceous." *E. elegans* has never been properly recognised. If it is indeed structurally like *E. campaniformis*, it should represent a quite peculiar colour phase of that species. It is, however, possibly a variety of *E. lepeleterii*.

Eumenes campaniformis var. *formosus*, H. de Saussure.

Eumenes formosa, H. de Saussure, Et. Fam. Vesp., i, 1852, p. 55 (no sex).

Eumenes lepeleterii var. *formosa*, H. de Saussure, Et. Fam. Vesp., iii, 1856, p. 131.

Eumenes caffer, typical form, J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, p. 72 (♀♂) (not of Linnaeus).

This was quite briefly defined by H. de Saussure as follows: "Black, ornamented with yellow. Abdomen bearing a black cross. Size of *E. campaniformis*, and quite closely allied to that species, from which it differs in the following characters: Antennae brown. Tegulae ferruginous, with a yellow spot. Petiole [=first abdominal segment] swollen from the middle on, thence uniformly wide in its entire posterior part, ferruginous, with two yellow spots at the apex, between which one sees a black spot shaped like a rounded lozenge, and with two yellow dots in its middle. Abdomen perfectly oval, yellow with a black cross. Legs ferruginous; tibiae yellow. Pleura yellow, with an oblique, black band. The remainder as in *campaniformis*." The type came from the Congo, and is at the British Musuem.

It is the most common colour phase of *E. campaniformis* in the

southern half of the African continent, and as such deserves a more complete description.

Black, abundantly marked with bright yellow as follows : clypeus entirely (in both sexes), a tinge on the inner half of mandibles, lower half of face (including most of the sinus of the eyes), broad outer orbits, pronotum, scutellum and postscutellum (except along the anterior and posterior margins), major part of propodeum (divided by a narrow, median, black stripe), mesopleura, a spot on the tegulae posteriorly, two spots (widely separated) before the apex of the first abdominal tergite, the second tergite except for a wide, black cross, the posterior half of the second sternite, most of the remaining segments of the abdomen (the yellow more or less distinctly interrupted on the tergites by the continuation of the black cross of the second tergite), the under side of the fore femora and the under side of all the tibiae. The following parts are ferruginous-red : most of the mandibles ; the antennae (brownish in the apical half on the upper side) ; part of tegulae ; mesosternum ; first abdominal segment (except for a short, black base and a black, preapical spot between the yellow spots, either lozenge-shaped or extending laterally into a cross band) ; the basal half of the second sternite ; the extreme base and sides of the second tergite ; and the legs (except where yellow). Wings subhyaline, amber-yellowish in the subcostal and more ferruginous in the costal cell ; a faint, somewhat purplish spot in the radial cell. Both sexes are practically coloured alike.

Length (h.+th.+t. 1+2) : ♀, 14 to 18·5 mm. ; ♂, 13 to 16·5 mm.

The similarity in coloration of *E. campaniformis* var. *formosus* and the typical colour phase of *E. lepeleterii* is most deceiving, and since both often occur in the same district, they are generally confused in collections. Probably most of the South African records of *E. lepeleterii* published in the literature were based upon specimens of *formosus*. In the male, the distinction is relatively easy owing to the different shape of the antennal hook. In the females, however, one must rely upon the shape of the first abdominal segment as seen from above.

Southern Rhodesia : Sebakwe, 1 ♀, November 1910 (D. Dods), and Bindura, 1 ♂ (D. Coghill), S.A. Mus. ; Matoppos, 1 ♀, May 26, 1912 (G. Arnold), Rhodesia Mus. ; Lomagundi, 1 ♀ (C. W. Howard), U.S. Nat. Mus.

Orange Free State : Vredefort, 1 ♀, S.A. Mus.

Natal : Mfongosi, several ♀ and ♂, March 1914, and March and April 1916 (W. E. Jones), S.A. Mus.

The var. *formosus* is common on the Lower Congo, but I have not yet seen it from Katanga.

A female from Abyssinia (Magretti Coll.), at the United States National Museum, differs from the above description of *formosus* in having a comma-shaped yellow mark on each side of the anterior half of the mesonotum, the two marks being separated by a ferruginous spot. Perhaps it represents a peculiar colour phase of north-eastern Africa.

Eumenes campaniformis var. *rhodesiensis*, new variety.

Female.—An extreme xanthic colour phase of *E. campaniformis*. Head, thorax, legs, and wings are coloured as in the var. *formosus*, de Saussure; but there is a narrow, yellow line on each side of the mesonotum, along the margin, just before the tegulae. The abdomen is almost completely bright yellow: the first segment is black at the extreme base, somewhat more extensively on the sternite, and the tergite has a black, elongate spot over the middle of the apical, dilated portion; the remainder of the first segment is ferruginous-red except for a long, yellow spot on each side of the black mark in the apical, dilated portion; these yellow spots are much widened laterally in their posterior half. The second tergite is yellow, with a median, longitudinal, more or less spear-shaped, black mark, forming in the basal third a stripe which is angularly dilated in the middle and tapers out in a long point posteriorly.

Length (h.+th.+t. 1+2): 16 mm.

Southern Rhodesia: Que Que (Bultitude), 1 ♀ (holotype), S.A. Mus.

Eumenes campaniformis var. *marshalli*, new variety.

Eumenes caffer var. *esuriens*, J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, p. 73 (♀♂) (not of Fabricius).

This colour phase has been fully described in the paper quoted. It differs mainly from the var. *formosus* in lacking the large, triangular, yellow spots at the base of the second tergite, so that the abdomen is not yellow with a black cross; the second tergite is more or less extensively ferruginous over the basal third. Frequently too the yellow markings are somewhat reduced on thorax or abdomen, but they are always much more abundant than in the var. *rendalli*, as there is a yellow, broadly interrupted band at the apex of the second and succeeding tergites.

Length (h.+th.+t. 1+2): ♀, 16 mm.; ♂, 14 mm.

Belgian Congo: Stanleyville, 1 ♀ (paratype), April 1915 (J. Bequaert); Coquilhatville, 1 ♂ (paratype), June 24, 1924 (Maurice Bequaert); Bogoro, 1 ♂ (paratype), July 10, 1914 (J. Bequaert).

Southern Rhodesia: Lomagundi, 1 ♂ (paratype), November 1909 (C. W. Howard), U.S. Nat. Mus.; Salisbury, 1 ♀ (holotype) and 1 ♂, April 1900 (allotype) (G. A. K. Marshall); in coll. Brauns, Salisbury, 1 ♀ (paratype), May 1914 (D. Dodds), S.A. Mus.

I have received a pair from Dr. Brauns marked as types of "*E. lepeleterii* var. *marshalli*, A. v. Schulthess," but, so far as I can discover, this name has not been published. The shape of the first abdominal segment, as well as of the male antennal hook, leave no doubt to my mind that these specimens should be regarded as a variety of *E. campaniformis* and not of *E. lepeleterii*.

I suspect that the specimens from Katanga (between Mufungwa and Kayumbe; between Shawa and Kundiganga; and Kabinda), recorded under the name *E. maxillosus* var. *pulcherrimus* by Schouteden (Rev. Zool. Afric., vi, 1919, p. 174), are *E. campaniformis* var. *marshalli*.

The var. *marshalli* is quite similar in livery to the wasp described by A. v. Schulthess under the name *Eumenes maxillosus* var. *pulcherrimus*. Since, however, I am as yet undecided as to the exact status of *pulcherrimus*, the use of that name for the Central African form here called *marshalli* might be the source of much confusion.

Eumenes campaniformis (?) var. *pulcherrimus*, A. v. Schulthess.

Eumenes maxillosus var. *pulcherrimus*, A. v. Schulthess, Societas Entomol., xxv, 1910, p. 17 (♀). J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 59 and 281.

Eumenes janseii, P. Cameron, Ann. Transvaal Mus., ii, 3, 1910, p. 157 (♀).

This form was originally described upon eight females from "East Africa from the equator to Natal." In the material before me there are three specimens which were identified as "*E. maxillosus pulcherrimus*" by Dr. A. v. Schulthess and bear a "type" label. Of these, one female of Algoa Bay (H. Brauns) and one female of Roode Poort, near Johannesburg (G. Kobrow), are in Dr. H. Brauns' collection; while one male of Estcourt, Natal (E. Haviland), was received from the South African Museum. Obviously, however, these three specimens were not before the author when he drew up his description, and are therefore not true types. According to the labels they were identified in 1911. Moreover, A. v. Schulthess states in the original

account that the male was unknown (and I am not aware that it was ever described in print); neither does he include the Transvaal and Cape Province in the distribution. I must emphasise this, because an examination of the real types, used for the original description, might well lead to different conclusions.

The problem is further complicated through the fact that these three specimens, although practically coloured alike, appear to belong to two species upon morphological grounds.

The male of Estcourt and the female of Roode Poort are structurally like *E. campaniformis*, and I have little doubt that they belong to that species. They have the same shape of the first abdominal segment, head, thorax, and hind tarsi in the female. Whereas the antennal hook and genitalia of the male are those of *E. campaniformis*, and not of *E. maxillosus*.

The coloration of these two specimens is as follows :—

Female.—Black, extensively marked with ferruginous and bright yellow. Mandibles (except the black tip), basal half and under side of antennae, tegulae, first abdominal segment (except for the black base, continuing as a median stripe ventrally, and a black, mushroom-shaped spot at apex of tergite), basal third of second tergite (except for the black neck), the sides of second sternite quite broadly (the black forming a large T), the tip of abdomen diffusely, and most of the legs, bright ferruginous-red. The following parts are yellow : clypeus (except for narrow, black margins along inner orbits); the lower half of the front (except for black spots above the base of antennae); outer orbits narrowly above; anterior half of pronotum; a large spot in upper part of mesopleura extending below the suture between the two plates; a broad, transverse band on scutellum; posterior half of postscutellum; a large, elongate spot on each side of propodeum; a preapical spot on each side of first tergite; broad apical bands on tergites 2, 3, and 4, very widely interrupted in the middle; indefinite spots on fifth tergite; an apical band on second sternite; and outer side of all tibiae and of fore femora. Wings subhyaline, with amber-yellow tinge, especially in anterior half; the radial cell somewhat cloudy and purplish.

Length (h.+th.+t. 1+2) : 17·5 mm.

Male.—Almost exactly like the female; the yellow markings somewhat more pronounced behind the fourth abdominal segment.

Length (h.+th.+t. 1+2) : 17 mm.

I have seen three other females from Natal(Estcourt and Clairmont), which agree in every structural detail with the specimen from Roode

Poort and are coloured exactly like it. I have no doubt that all these five specimens represent a colour phase of *E. campaniformis*, which differs only from the var. *marshalli* in the yellow markings being more extensive on the abdomen. If, as I surmise, A. v. Schulthess' original types of East Africa belonged to the same colour phase of *E. campaniformis* as here described, it is quite probable that *marshalli* will be regarded as a synonym of *pulcherrimus*.

I should have felt no hesitation in doing so, were it not for the female from Algoa Bay. That specimen, although coloured nearly exactly like the one from Roode Poort described above, has a quite different aspect. The head is about as high as broad ; the posterior ocelli are nearly as far from the inner orbits as from each other ; the thorax is rather short and broad ; the first tergite, though in outline like that of *E. campaniformis*, is relatively broader behind ; the second sternite is normally convex ; the hind tarsi are but little longer than the hind femur and trochanter ; the sides of the propodeum are completely rounded off. Length (h.+th.+t. 1+2) : 20 mm. I feel reasonably certain that this specimen is not a colour phase of *E. maxillosus*. Quite possibly it is a mere robust variation of *E. campaniformis*. On the other hand, it reminds one a great deal of *E. caffer*, and it is, of course, not impossible that *E. caffer* presents a colour phase of the *pulcherrimus* pattern. The discovery of the corresponding male alone can solve the problem. I may also call attention to the fact that no colour phase of genuine *E. campaniformis* has as yet been recorded from the Cape Province.

In the South African Museum there is a female, unfortunately without locality, which I regard as belonging to the same form as the female from Algoa Bay here discussed.

Eumenes campaniformis var. *rendalli*, Bingham.

Eumenes rendalli, C. T. Bingham, Ann. Mag. Nat. Hist., (7), x, 1902, p. 220 (♀ ; not the ♂). J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, p. 283.

Eumenes caffer var. *gracilis*, J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, p. 72 (♀♂). Not of de Saussure.

An examination of the types of *E. rendalli*, at the British Museum, shows that the female represents a peculiar colour phase of *E. campaniformis* ; while the male has all the structural characters (shape of first segment and especially of antennal hook) of *E. lepeleterii* and the coloration of the var. *concinnus*, H. de Saussure, of that species. The

name *rendalli* is herewith restricted to the colour phase of *campaniformis* represented by the female type.

The following description is based upon the female type : Head and thorax, including propodeum, extensively ferruginous ; the vertex and hind part of the temples, the apical half of the flagellum above, small spots on pronotum, mesonotum, the sutures of the thorax, and a median band on the propodeum, black. Legs rufous-red. First abdominal segment ferruginous, except for a short, black base and a broad, irregular, black band in the widened part, before the apex ; second tergite black, with ferruginous basal third and indefinite ferruginous spots on the sides near the apical margin ; the succeeding tergites black, with dirty yellow or orange apical margins ; the abdominal sternites are almost entirely ferruginous. Wings subhyaline with amber-yellow tinge ; the radial cell with a brown, purplish spot covering the apical two-thirds. The face (including clypeus) and outer orbits were evidently yellow in life, but they have turned orange. Length (h.+th.+t. 1+2) : 17 mm.

A male from Mlanje, Nyasaland, at the British Museum, agrees in coloration with the type, and, since it possesses the characteristic antennal hook of *E. campaniformis*, I regard it as the true male of the var. *rendalli*.

I refer to the var. *rendalli* specimens from the following localities :—

Belgian Congo : Boma, June 15, 1915, 1 ♀ and 1 ♂ (J. Bequaert) ; Zambi, 1 ♂, June 22, 1915 (J. Bequaert).

Southern Rhodesia : Sebakwe, 1 ♀, November 1901 (D. Dods), S.A. Mus.

Nyasaland : Fort Johnston, several ♀ (including the holotype) (P. Rendall) ; Chitala Stream, 10 miles west of Domira Bay, several ♀, October 22-28, 1910 (S. A. Neave) ; Mlanje, 1 ♂ (allotype) (S. A. Neave) —all at the Brit. Mus.

A male from Walikale, Belgian Congo, agrees on the whole with *rendalli*, but has the pronotum quite broadly bright yellow. It may be regarded as a transition to the var. *marshalli*, from which it differs, however, in having no other yellow markings on the thorax and in the absence of yellow at the apex of the second tergite.

Eumenes campaniformis var. *pseudodyscherus*, new variety.

Eumenes caffer var. *dyscherus*, J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, p. 74 (♂). Not *Eumenes dyschera*, H. de Saussure, 1852.

Eumenes dyschera was described by H. de Saussure (Et. Fam. Vesp.,

i, 1852, p. 50) as of tropical Africa. In 1918, I believed to have recognised it in a melanistic form of *E. campaniformis*, of the Congo forest. An examination of de Saussure's type, at the British Museum, has, however, shown that the true *E. dyscherus* is South American and not African. In a recent note (Bull. Brooklyn Ent. Soc., xx, 1925) I regard *E. chalicodomae*, H. de Saussure, *E. centralis*, P. Cameron, and *E. magnus*, Brèthes, as synonyms of *E. dyscherus*.

The melanistic Congo colour phase of *E. campaniformis* I have named var. *pseudodyscherus*. It is mostly black. Mandibles, under side of antennae, tegulae, propodeum, sometimes also pronotum and mesopleura, first abdominal segment, sometimes base of second, and legs are more or less spotted with ferruginous. Clypeus entirely (in both sexes), a spot between the antennae, inner orbits below the sinus of eyes, a narrow line along outer orbits, and spots on the outer side of the tibiae, yellow. In the female, the anterior margin of the pronotum is also yellowish. The wings are as in typical *campaniformis*, subhyaline with amber-yellow tinge and a brown, purplish spot in the radial cell.

Length (h.+th.+t. 1+2) : ♀, 16 mm. ; ♂, 15 mm.

Belgian Congo : Stanleyville, 1 ♂ (holotype), April 1915 (J. Bequaert) ; Walikale, 1 ♀ (allotype) (J. Bequaert).

Eumenes dyschera, G. K. Marshall, Trans. Ent. Soc. London, 1902, pp. 525, 570, and 572, pl. xxi, figs. 16 (♂) and 17 (♀), and pl. xxii, fig. 14 (♂), of Salisbury, Southern Rhodesia, is neither *E. campaniformis* var. *pseudodyscherus* (which has clear, slightly yellowish wings) nor *E. dyschera*, H. de Saussure, but *E. lepeleterii* var. *hottentottus*, H. de Saussure.

Eumenes lepeleterii, H. de Saussure.

(Text-figure 12.)

The morphological characters of this species have been described and illustrated in Bull. Amer. Mus. Nat. Hist., xxxix, 1918, p. 74, figs. 57–62. In the female, the head as seen in front is distinctly broader than high ; the sides of the propodeum are completely rounded off between the dorsal and the ventral area ; the first abdominal segment is slender, as long as or slightly longer than the thorax ; seen from above it very gradually widens from base to apex, and is about four times as long as its greatest width ; second sternite not or scarcely depressed in the centre ; hind tarsi about as long as hind femur and trochanter. In the male, the first segment of the abdomen

is, as a rule, more slender than in the female ; the terminal hook of the antennae is quite long and slender, very gradually tapering from the base to the sharp, recurved apex, which rests in a pit on the under side and at about the middle of the tenth antennal segment.

E. lepeleterii is distributed over most of the Ethiopian and Malagasy regions, a large part of Arabia, Syria, and Egypt. It has also been reported from Cyprus. In South Africa it appears to extend much beyond the limits which I had traced on the map in 1918. It is

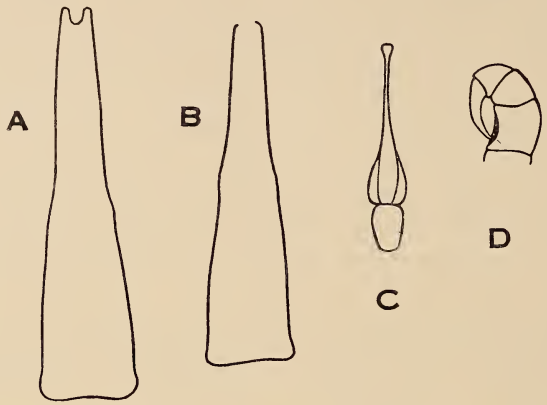

Fig. 12.—*Eumenes lepeleterii*, H. de Saussure. *A*, first tergite of female from above ; *B*, first tergite of male from above ; *C*, penis from above ; *D*, terminal segments of male antenna.

there generally represented by the colour phases *concinnus*, de Saussure, and *hottentottus*, de Saussure.

Since I have not yet been able to study all the described colour variations, I am unable to improve much upon my former treatment. *E. alluaudi*, J. Pérez, is a distinct species, allied not to *E. lepeleterii*, but to *E. maxillosus*.

Key to Colour Phases of E. lepeleterii.

1. Thorax and abdomen black or black and ferruginous-red, almost without yellow or ivory-white markings 2
   Abdomen or thorax, or both, extensively marked with yellow or ivory-white. Wings subhyaline, more or less tinged with amber-yellow . . . 4
2. Wings much infuscated, with purplish reflections. Body almost wholly black, slightly ferruginous on parts of head, thorax, legs, and first segment of abdomen. Head with a few yellowish spots.
   var. *hottentottus*, H. de Saussure
   Wings subhyaline, slightly tinged with amber-yellow 3
3. Body almost wholly black, slightly ferruginous on parts of head, thorax, legs,

and first abdominal tergite, and also along the apical margins of the last tergites. Head and thorax with a few ivory-white spots.

var. *guerini*, H. de Saussure

Body extensively ferruginous-red, with black markings; as a rule a black cross over the second abdominal tergite. Ivory-white markings much reduced, generally restricted to the clypeus and spots on the head.

var. *concinnus*, H. de Saussure

4. Yellowish markings abundant on head, thorax, and abdomen; the second and succeeding tergites of the abdomen mostly yellow, with a distinct black or ferruginous cross, the branches of which run over the second tergite . 5

Yellowish markings much more reduced on abdomen, with a few spots only on the first or first and second tergites 6

5. Mostly black and yellow; the ferruginous colour much reduced in extent; the cross of the abdomen black . . . . typical *lepeleterii*

Black colour almost entirely replaced by ferruginous-red; the cross of the abdomen ferruginous . . . . var. *asinus*, H. de Saussure

6. Form of Madagascar. Mostly black with rufous tinges. Postscutellum and first and second abdominal tergites with a narrow, ivory-white fascia.

var. *pensilis*, H. de Saussure

Forms of the African continent 7

7. Head and thorax abundantly marked with yellow; two apical spots on first tergite and the outer side of the legs yellow; ferruginous colour much reduced . . . . . var. *tessmanni*, A. v. Schulthess

Black with a few brownish-red tinges on head, thorax, legs, the under side of the abdomen, and the last abdominal tergites. Inner orbits, a narrow fascia on the postscutellum, two spots before the apex of first tergite, and a narrow apical band on first and second tergites, pale yellow.

var. *stuhlmanni*, A. v. Schulthess

Eumenes lepeleterii, typical colour phase.

Eumenes lepeleterii, H. de Saussure, Et. Fam. Vesp., i, 1852, p. 45, pl. x, fig. 3 (♀) (the figure is misleading and does not agree with the description). J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 77 and 276 (♀♂).

Eumenes granti, W. F. Kirby, Bull. Liverpool Mus., iii, 1900, p. 18 (♀).

Eumenes meruensis, P. Cameron, Wiss. Ergebn. Schwed. Zool. Exp. Kilimandjaro, ii, 8, 6, 1910, pp. 175 and 176 (♀).

The typical colour phase of the species was originally described from the Senegal. It has been very often recorded in the literature, but I suspect that in many cases it was confused with *E. campaniformis* var. *formosus*, H. de Saussure, or *E. melanosoma* var. *affinis*, A. v. Schulthess, of which it is a perfect mimic. At any rate, it is rather strange that I have not yet seen a South African specimen of true *lepeleterii*. It occurs, however, on the Lower Congo (Boma, Matadi, and Noki). I have examined, at the United States National

Museum, a female from the Jombene Hills, Kenya Colony (Chanler-Hohnel Expedition), which agrees still better with the original description than the Congo specimens. Schouteden (Rev. Zool. Afric., vi, 1919, p. 174) has listed the typical form from Dungu (north-eastern Congo) and Bunkeya (Katanga), but I have not seen these specimens. The distribution cannot be correctly stated at present.

I am using the original spelling of the name, which has also been variously written *lepeletieri* or *lepelletieri*.

Eumenes lepeleterii var. *asinus*, H. de Saussure.

Eumenes asina, H. de Saussure, Et. Fam. Vesp., i, 1852, p. 59, pl. xi, fig. 1 (♀) (Senegal).

Eumenes lepeleterii var. *asinus*, A. v. Schulthess, Societas Entomol., xxv, 1910, p. 24. J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 77 and 277.

I am merely following A. v. Schulthess, who states to have seen the type (at the Paris Museum), in referring *E. asina* as a colour phase to *lepeleterii*. I have never seen it, and, so far as I know, no additional specimens have been collected. H. de Saussure's figure would rather give one the impression of a form of *E. campaniformis*, in the shape of the first abdominal segment.

Eumenes lepeleterii var. *pensilis*, H. de Saussure.

Eumenes pensilis, H. de Saussure, in Grandidier, Hist. Phys. Nat. Madagascar, xx, pt. 1, Hym., 1890, p. 155, pl. iv, fig. 10, and pl. xvii, fig. 7 (♀♂).

Eumenes lepeleterii var. *pensilis*, A. v. Schulthess, Societas Entomol., xxv, 1910, p. 17 (♀♂). J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 77 and 278.

Known from Madagascar only. It appears to be quite close to the var. *stuhlmanni*, and it is not clear how the two might be distinguished. I have not seen it.

Eumenes lepeleterii var. *stuhlmanni*, A. v. Schulthess.

Eumenes lepeleterii var. *stuhlmanni*, A. v. Schulthess, Societas Entomol., xxv, 1910, p. 18 (♀). J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 77 and 278.

This was originally described from Tanganyika Territory (German East Africa), without more definite locality, and I have not seen specimens that agree quite with the description.

Eumenes lepeleterii var. *tessmanni*, A. v. Schulthess.

Eumenes lepeleterii var. *tessmanni*, A. v. Schulthess, Societas Entomol., xxv, 1910, p. 18 (♀♂). J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 77 and 278.

Eumenes cameruna, "F. Kohl," A. v. Schulthess, Mitt. Zool. Mus. Berlin, vi, 3, 1913, p. 342 (as a synonym).

Described from Spanish Guinea, Benito. I have seen male and female from Lolodorf, Cameroon : in these specimens there are orange-yellow spots in the apical corners of the posterior sternites of the abdomen, which are not mentioned in the original description. The var. *tessmanni* mimics *E. melanosoma* var. *aethiopicus*.

Eumenes lepeleterii var. *concinnus*, H. de Saussure.

Eumenes concinnus, H. de Saussure, Et. Fam. Vesp., iii, 1856, p. 144 (♂).

Eumenes lepeleterii var. *concinnus*, A. v. Schulthess, Societas Entomol., xxv, 1910, p. 17 (♀♂). J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 77 and 277.

Eumenes sanguinolenta, Gerstaecker, Monatsb. Preuss. Ak. Wiss. Berlin, 1857, p. 463 (♂).

Eumenes spilocera, P. Cameron, Ann. Transvaal Mus., ii, 3, 1910, pp. 159 (♀) and 160.

Since this is a common South African wasp, it may be more fully described.

Female.—Extensively ferruginous-red ; it might well be described as a typical *lepeleterii* in which the yellow has been replaced by ferruginous. The black markings are as follows : upper half of front ; vertex ; temples ; mesonotum ; mesopleura (except for a rufous spot in the upper half) ; metapleura ; margins of scutellum and post-scutellum ; a median stripe on the propodeum ; extreme base, under side, and an elongate, spear-shaped spot on the posterior dorsal half of the first abdominal segment ; an elongate spot on the second sternite ; a cross over the second tergite, the base of the succeeding segments, and the under side of the hind femora in part. The yellowish colour is usually confined to the narrow outer orbits (often orange) and the lateral ridges which connect scutellum and postscutellum with the base of the wing. Occasionally the lower inner orbits (from the clypeus to the bottom of the ocular sinus), the very centre of the clypeus, spots between the antennae, the extreme apical corners of the first tergite, and the base of the fore tibiae may be yellowish. The

wings are intensively amber-yellow, darkened and more purplish toward the tip.

Male.—Agrees quite well with the female. Generally the clypeus is entirely pale yellow, but I have also seen males in which it is ferruginous (perhaps discoloured artificially). Often too there is a short, transverse, pale yellow line in the centre of the pronotum, and this may be faintly indicated even in certain females.

Length (h.+th.+t. 1+2) : ♀, 16·5 to 19 mm. ; ♂, 12 to 16·5 mm.

Originally described form Nubia, it occurs throughout East and South Africa. I have also a pair from Fort Crampel, in the Ubangi Territory of French Equatorial Africa, which are somewhat more extensively black than usual, but still have subhyaline, amber-yellow wings.

Katanga : Lubumbashi, several ♂ and ♀, April, May, June, and December 1920, and January 1921 (Mich. Bequaert). Apparently a common wasp in that part of the Belgian Congo. Schouteden (Rev. Zool. Afric., vi, 1919, p. 175) lists it from several additional localities, but whether the specimen he records from Boma was correctly named remains to be seen.

Southern Rhodesia : Lonely Mine, 1 ♀, June 29, 1913, and April 11, 1914 (H. Swale) ; Salisbury, June 1913, 3 ♂, S.A. Mus.

Transvaal : Kaapmuiden, 2 ♂ and 1 ♀, October and November 1918 (R. W. E. Tucker), S.A. Mus.

Natal : Mfongosi, 6 ♂, March 1917, and April and May 1916 (W. E. Jones) ; Durban, 1 ♀ (W. Haygarth) ; Stella Bush, 1 ♀ (Marley), S.A. Mus.

Cape Province : Dunbrody, 1 ♀ and 1 ♂ (J. O'Neil) ; Mossel Bay 1 ♀ (Overbeck) ; Hex River, 1 ♂, S.A. Mus. ; Ceres and Mossel Bay, several specimens (R. E. Turner), Brit. Mus. ; Willowmore, 1 ♀, April 1, 1906 (H. Brauns).

While the female of Kaapmuiden agrees with the var. *concinnus* in every respect, the two males of the same locality differ conspicuously in having fairly large, pale yellow spots near the apex of the first tergite, and on each side of the apex of the second tergite a transverse, pale yellow spot. I have seen similar males from the Semliki Valley, north-eastern Congo, and Lubumbashi, Katanga. At one time I was inclined to refer them to the var. *stuhlmanni*. They possibly represent a distinct colour phase or perhaps are transitional between var. *concinnus* and var. *stuhlmanni*. I do not wish to name them for the present, since they might be *E. lepeleterii* var. *thoracicus*, Schouteden (Rev. Zool. Afric., vi, 1919, p. 175), mentioned, but not described, from Katanga (between Kambove and Bunkeya—S. A. Neave).

Eumenes lepeleterii var. *hottentottus*, H. de Saussure.

Eumenes hottentotta, H. de Saussure, Et. Fam. Vesp., i, 1852, p. 63 (♀).
Eumenes lepeleterii var. *hottentottus*, A. v. Schulthess, Deutsche Entom. Zeitschr., 1914, p. 291 (♀♂). J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 77, 78, and 278 (♀♂).
Eumenes dyscheroides, Gribodo, Mem. Accad. Sc. Bologna, Sc. Nat., (5), v, 2, 1895, p. 93 (♂).

A common form throughout South Africa. It extends, however, as far as Cameroon (Batanga) and the northern Belgian Congo (Boma, Lubutu, Coquilhatville, Stanleyville). In coloration it resembles the typical form of *E. maxillosus* so exactly that much caution is needed to separate them. The extent of ferruginous is somewhat variable, but usually slight, and it is readily distinguished from the var. *concinnus* by the black, purplish wings.

Katanga: Lubumbashi, 1 ♂ and 1 ♀, July and November 1920; and Panda River, 1 ♀, October 1920 (Mich. Bequaert).

Portuguese East Africa: Lourenco Marques, several ♀ and ♂ (H. Junod).

Natal: Mfongosi, 1 ♂, March 1917 (W. E. Jones), S.A. Mus.; Durban, 1 ♀.

Cape Province: Dunbrody, 1 ♂ and 1 ♀, January 1912 (J. O'Neil); Henkries, Bushmanland, 2 ♀ and 1 ♂, October 1911 (Lightfoot); Salem, 1 ♂, S.A. Mus.

Eumenes lepeleterii var. *guerini*, H. de Saussure.

Eumenes guerini, H. de Saussure, Et. Fam. Vesp., i, 1852, p. 62 (♀).
Eumenes lepeleterii var. *guerini*, J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 77 and 277.
Eumenes sakalava, H. de Saussure, Abh. Senckenberg. Naturf. Ges., xxvi, 2, 1900, p. 235 (♀♂).

Known from Madagascar only. I have not seen it. It seems to differ from the var. *hottentottus* mainly in the more extensive ferruginous markings and the subhyaline, amber-yellow wings. It is by no means clear how it may be differentiated from certain specimens of the var. *concinnus*.

Eumenes maxillosus (de Geer).

(Text-figure 13.)

This is the largest of the African *Eumenes*, but it varies much in size. Structurally it is related to both *E. campaniformis* and *E.*

lepeleterii, of which it often assumes the several colour patterns. In the female the head as seen in front is scarcely broader than high; the eyes are slightly farther apart at the clypeus than on the vertex, and the posterior ocelli are about twice as far apart as from the inner orbits; the sides of the propodeum are somewhat angular or even faintly ridged between the dorsal and the ventral areas, especially in the lower half; the first abdominal segment is rather stout, distinctly shorter than the thorax; seen from above it is distinctly divided by a slight contraction into a basal, stalk-like and a much broader, apical portion; the hind portion widens rather conspicuously at the apex,

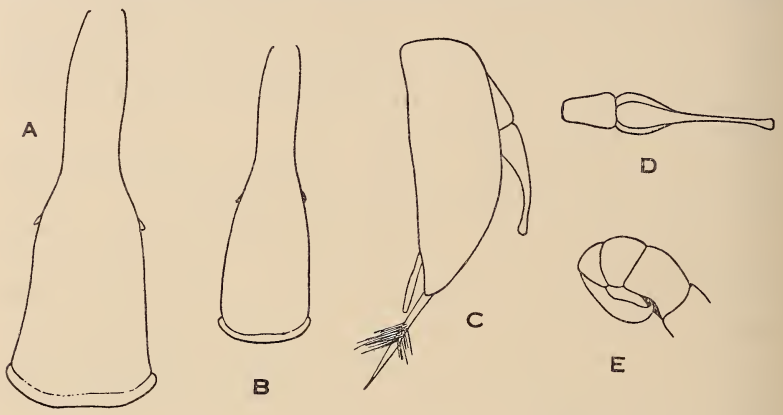

Fig. 13.—*Eumenes maxillosus* (de Geer). *A*, first tergite of female from above; *B*, first tergite of male from above; *C*, male genitalia in profile, outer view; *D*, penis from above; *E*, terminal segments of male antenna.

where its width is variable, usually about one-third of the total length of the segment; the second sternite is more or less depressed in the centre, often quite deeply so, especially in large specimens; sometimes, however, the sternite is just barely flattened, and this is the usual condition in the var. *fenestralis*, which is the smallest of all the colour phases of *maxillosus*; the anterior margin of the clypeus is, as a rule, quite straight or faintly curved, either inwardly or outwardly; hind tarsi relatively slender, much longer than hind femur and trochanter. Almost all these characters hold in the male, which, in addition, may be recognised by the peculiar hook of the antennae: it is very long and thick, curved and somewhat contracted beyond the base, the terminal half distinctly swollen in profile and widened seen from above; it ends in a sharp, strongly bent apex, which reaches the base of the tenth antennal segment; it rests there in a broad and deep excavation at the under side of the segment; the eyes are about equally far

apart on the vertex as at the clypeus; the posterior ocelli are quite close to the inner orbits, being more than twice as far apart; the hind (and also middle) tarsi are still more strikingly slender than in the female.

I have endeavoured to discover additional characters in the male genitalia of *E. campaniformis*, *E. lepeleterii*, and *E. maxillosus*, but the differences appear to be so slight that they are of little specific value. I have figured the penis of all three species.

The structural characters of *E. maxillosus* have been illustrated in Bull. Amer. Mus. Nat. Hist., xxxix, 1918, p. 57, figs. 39, 40. It should be noted, however, that the female antenna is there drawn as 13-segmented, which is an obvious error; it possesses 12 segments in this, as in all other *Eumenes* known to me.

The distribution of *E. maxillosus* is similar to that of *E. campaniformis*, though more extensive, since it includes the whole of Africa (except Morocco, Algeria, and Tunis), Madagascar, Arabia, Syria, Mesopotamia, Persia, the Oriental region as far as southern China, the Malay Archipelago, the Papuan region, and the north-eastern half of Australia.

Over this vast area *E. maxillosus* has produced more different colour phases than any other species of *Eumenes*. Every one of these colour variations has a much more restricted range than that of the morphological species as a whole; yet generally two or more of them occur together in the same region, so that I am unable to regard them as geographically segregated races. Neither do they, as a rule, exhibit gradual passage into one another at the limits of their respective ranges; such geographical intergradation is, I understand, the essential criterion of the subspecific concept as used by students of vertebrates. Nevertheless, as these several colour phases are morphologically identical, it would, in my opinion, obscure the whole matter to regard them individually as species, merely because they do not fit the current conception of subspecies or races. There can be no doubt that they are genetically quite closely related. There are many other interesting problems suggested by the study of variation in this species. I have briefly discussed them before,* and I shall not take up the matter again for the present.

Since publishing my account of *E. maxillosus* in 1918, I have examined much additional material, so that I am able to correct

* See Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 59–65. Also J. Bequaert, Enkele beschouwingen over kleuren en kleurgroepen by Plooivleugelige Wespen, Natuurwetensch. Tijdschr. Antwerpen, v, 1923, pp. 16–27 (with corrected maps).

and extend my conclusions in many particulars. The subjoined key of the colour phases should replace my former attempt in that direction. The main difference lies in the recognition by name of a number of additional colour variations. As I have shown in the discussion of *E. campaniformis*, the var. *pulcherrimus*, A. v. Schulthess, does not belong to *E. maxillosus*, but (as far as East Africa is concerned) to *E. campaniformis*. The distribution of the several extra-African variations may be succinctly indicated.

1. Var. *circinalis*, Fabricius (*Eumenes circinalis*, Fabricius, Syst. Piezat., 1804, p. 286; *Eumenes latreillei butonensis*, W. A. Schulz, Berlin Ent. Zeitschr., xlix, (1904) 1905, p. 218, ♀). India, Siam, Indo-China, Sumatra, Java, Borneo, and the Molucca Islands.

2. Var. *conicus* (Fabricius) (*Vespa conica*, Fabricius, Syst. Entom., 1775, p. 372). Oriental region, from India to southern China.

3. Var. *fulvipennis*, F. Smith (*Eumenes fulvipennis*, F. Smith, Cat. Hym. Brit. Mus., v, 1857, p. 24, ♀♂). Celebes and Philippine Islands. One finds all intergrades between this and the var. *circinalis*.

4. Var. *latreillei*, H. de Saussure (*Eumenes latreillei*, H. de Saussure, Et. Fam. Vesp., i, 1852, p. 51, pl. x, fig. 5, ♀; *Eumenes latreillei petiolaris*, W. A. Schulz, Berlin. Ent. Zeitschr., xlix, (1904) 1905, p. 217, ♀). North-eastern Australia to New South Wales, New Guinea, and Solomon Islands. I have seen a "type" of *petiolaris*, Schulz, at the British Museum.

5. Var. *nigritarsis*, G. Meade Waldo (*Eumenes nigritarsis*, G. Meade Waldo, Ann. Mag. Nat. Hist., (8), v, 1910, p. 43, ♂). Region of Port Darwin, northern Australia. I have examined the type at the British Museum. It differs mainly from the var. *latreillei* in the markings of the thorax being bright yellow and not orange. All the structural characters of *E. maxillosus* are present.

6. Var. *pyriformis* (Fabricius) (*Vespa pyriformis*, Fabricius, Syst. Entom., 1775, p. 371; *Vespa petiolata*, Fabricius, Spec. Insect., i, 1781, p. 467). Oriental region, from India to southern China. W. A. Schulz, who examined the type of *Vespa pyriformis* at the Copenhagen Museum, concluded that it was the same as *Vespa petiolata*, Fabricius, as was suspected by de Saussure (Et. Fam. Vesp., iii, 1856, p. 133). *Vespa petiolata*, Fabricius, is of later date, and, moreover, is preoccupied by *Vespa petiolata*, de Geer, 1778.

7. Var. *xanthurus*, H. de Saussure (*Eumenes xanthura*, H. de Saussure, Et. Fam. Vesp., i, 1852, p. 46, pl. x, fig. 4, ♀). India, Indo-China, Malay Archipelago.

Eumenes insularis, F. Smith, Cat. Hym. Brit. Mus., v, 1857, p. 27,

♀♂, of the Solomon Islands or New Hebrides, agrees in coloration with the var. *circinalis*. An examination of the types, however, shows that it is structurally distinct from *E. maxillosus*. The same is true for *Eumenes philantes*, H. de Saussure, and *Eumenes fluctuans*, H. de Saussure, of which I have seen the types at the British Museum, and also of *Eumenes bicinctus*, H. de Saussure. *E. philantes*, *E. bicinctus*, and *E. maxillosus* var. *latreillei* mimic one another in a most deceiving fashion, presenting, together with many other Hymenoptera of that region, a distinctively Australian and Papuan colour pattern.

Key to Colour Phases of E. maxillosus.

1. Thorax and abdomen black or black and ferruginous, without yellow or orange-yellow markings 2
   Thorax, or abdomen, or both, more or less marked with yellow or orange-yellow 9
2. Wings entirely black, with purple reflections. Body black, more or less blotched with ferruginous on head, thorax, legs, and abdomen 3
   Wings not uniformly purplish black 4
3. Rather extensively ferruginous . . . . . var. *savignyi*, Guérin
   But little ferruginous, often almost pure black . . typical *maxillosus*
4. Thorax and abdomen almost pure black, with very few, dull ferruginous blotches 5
   Thorax or abdomen, or both, extensively and more brightly ferruginous . 6
5. Wings dark brown or black in their basal half, hyaline and somewhat milky in their apical half . . . . . var. *reginus*, H. de Saussure
   Wings suffused all over with amber-yellow, somewhat darker or brownish toward the base . . . . . var. *fulvipennis*, F. Smith
6. Wings hyaline with amber-yellow tinge in their basal half; their apical half bright purplish-black. Ferruginous-red, with the posterior half of the abdomen and rarely also the mesonotum black.
   var. *dimidiatipennis*, H. de Saussure
   Wings uniformly suffused with amber-yellow or rufous, occasionally somewhat darker toward the base or toward the extreme tip 7
7. Thorax and abdomen almost entirely bright ferruginous-red; the second tergite always with a distinct, narrow, transverse, black band, sometimes interrupted in the middle. Head orange-yellow. var. *conicus* (Fabricius)
   Not entirely ferruginous-red and without a narrow, black line on the second tergite 8
8. Mostly black; more or less blotched with ferruginous on head, prothorax, mesopleura, propodeum, legs, and first abdominal segment; often the first segment only ferruginous. Wings uniformly brownish-yellow, but little darker toward the base . . . . . var. *circinalis*, Fabricius
   Black, with the head, anterior half of the thorax, and posterior part of the abdomen (including hind margin of second tergite) ferruginous or slightly orange. Wings somewhat more conspicuously darkened in the basal half.
   var. *xanthurus*, H. de Saussure

9. Abdomen extensively yellow or orange-yellow. Wings amber-yellow, often darker toward the apex 10

Abdomen with few or no yellow spots (at most two large spots near apex of first tergite or the posterior segments orange-red) 11

10. Body conspicuously bright yellow, ferruginous-red, and black. The black forms a distinct transverse fascia on the second tergite between the basal, ferruginous and the apical yellow area; the head, anterior half of thorax, and posterior half of abdomen are mostly bright yellow. Wings nearly uniformly amber-yellow . . . . var. *pyriformis* (Fabricius)

Clypeus, front, antennae, pronotum, upper part of mesopleura, propodeum, anterior part of mesonotum (wholly or partly), first tergite (mostly), posterior third of second tergite, succeeding tergites and sternites, and legs (mostly) orange-yellow. The remainder of the body black. Wings brilliantly golden-yellow, the apical fourth purplish black.

var. *latreillei*, H. de Saussure

11. Head more or less marked with yellow, especially in male; thorax practically without yellow (at most a narrow margin on pronotum). Two rectangular, elongate, well-marked spots on the apical part of the first tergite. Otherwise black and ferruginous. Wings hyaline, slightly tinged with yellow, and smoky in the radial cell . . . var. *fenestralis*, H. de Saussure

Head and thorax extensively marked with bright yellow; the mesonotum black, with a comma-shaped spot on each side in its anterior half . . 12

12. Propodeum yellow. Abdomen black, more or less ferruginous on the first two segments . . . . . var. *tropicalis*, H. de Saussure

Propodeum ferruginous. Abdomen more extensively ferruginous-red; the third to sixth segments mostly orange-red. var. *nigritarsis*, G. Meade Waldo

Eumenes maxillosus, typical colour phase.

Vespa maxillosa, de Geer, Mém. Hist. Ins., iii, 1773, p. 577, pl. xxix, figs. 1 and 2.

Eumenes maxillosus, H. de Saussure, in Grandidier, Hist. Phys. Nat. Madagascar, xx, pt. 1, Hym., 1890, p. 153 (♀♂). J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 56, 67, and 279 (♀♂).

Sphex tinctor, Christ, Naturgesch. d. Insect., 1791, p. 311, pl. xxxi, fig. 1.

Vespa guineensis, Fabricius, Entom. Syst., ii, 1793, p. 277.

Eumenes erythrospila, P. Cameron, Wiss. Ergebn. Schwed. Zool. Exp. Kilimandjaro, ii, 8, 6, 1910, pp. 175 and 178 (♀♂).

Eumenes tinctor var. *minor*, Magretti, Ann. Mus. Civ. Genova, xxi, 1884, p. 609 (♀).

The typical form occurs over nearly the whole of Africa (except Morocco, Algeria, Tunis, Tripoli, and Egypt), Madagascar, and south-western Arabia, being perhaps the most common wasp of that part of the world.

Katanga : Lubumbashi ; Uimilolo River ; Panda River, common (Mich. Bequaert).

Northern Rhodesia : Victoria Falls (L. Péringuey), S.A. Mus.

Southern Rhodesia : Bulawayo (G. Arnold) ; Sebakwe (D. Dods) ; Bindura (D. Coghill) ; Salisbury, S.A. Mus.

Portuguese East Africa : Lourenco Marques (C. W. Howard).

Natal : Mfongosi (W. E. Jones) ; Pt. Shepstone (K. Barnard) ; Durban (W. Haygarth), S.A. Mus.

Cape Province : Lion's Head, Cape Town and Mossel Bay (R. E. Turner), Brit. Mus.

There are at the British Museum four specimens (♀ and ♂) of typical *maxillosus*, from Porto Grande, St. Vincent, W.I., which were accidentally introduced with ships.

Eumenes maxillosus var. *savignyi*, Guérin.

Eumenes savignyi, Guérin, Icongr. Règne Animal, ii, Atlas, 1835, pl. lxxii, figs. 4 and 4*a*–4*d* ; iii, Texte, Ins., 1844, p. 446. Spinola, Ann. Soc. Ent. France, vii, 1838, p. 503 (♀♂).

Savigny, Descr. Egypte, Atlas, Zool., Ins. Hym., 1812, pl. viii, fig. 4 (without name).

Eumenes tinctor var. *ferruginea*, Magretti, Ann. Mus. Civ. Genova, xxi, 1884, p. 610 (♀♂).

This differs so little from the typical form that it hardly deserves a name. Since it is the only colour phase found in Egypt, certain entomologists may wish to distinguish it ; they should, however, be aware that all transitions to the darker, typical *maxillosus* may be found. Often the wings are more russet than black. I have seen *savignyi* from the Fayum, Cairo, and Khartoum.

The name should be credited to Guérin and not to Spinola.

Eumenes maxillosus var. *dimidiatipennis*, H. de Saussure.

Eumenes dimidiatipennis, H. de Saussure, Et. Fam. Vesp., i, 1852, p. 51 (♀♂).

Eumenes maxillosus var. *dimidiatipennis*, A. v. Schulthess, Societas Entomol., xxv, 1910, p. 17. J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 59 and 280.

Eumenes transcaspicus, F. Morawitz, Horae Soc. Ent. Rossicae, xxix, 1895, p. 414 (♀♂).

This is found in north-eastern Africa, from southern Algeria and

the central Sahara to Somaliland, Arabia, Sokotra, Palestine, Syria, Persia, Transcaspia, and western India.

Eumenes maxillosus var. *reginus*, H. de Saussure.

Eumenes regina, H. de Saussure, Et. Fam. Vesp., i, 1852, p. 49, pl. x, figs. 8 and 8*a-b* (♀).

Eumenes maxillosus var. *reginus*, A. v. Schulthess, Societas Entomol., xxv, 1910, p. 17. J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 58 and 281.

Eumenes kohli, H. Brancsik, Jahresh. Naturw. Ver. Trencsiner Comit., xiii-xiv, 1891, p. 158 (♀).

Known from Madagascar and Nossi Bé only.

Eumenes maxillosus var. *tropicalis*, H. de Saussure.

Eumenes tropicalis, H. de Saussure, Et. Fam. Vesp., i, 1852, p. 54 (♀).

Eumenes maxillosus var. *tropicalis*, A. v. Schulthess, Societas Entomol., xxv, 1910, p. 17. J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 59, 69, and 281, pl. i, fig. 3 (♀♂).

Eumenes tropica, F. Smith, Cat. Hym. Brit. Mus.. v, Vesp., 1857, p. 27.

This is a common colour phase in West Africa, from Senegal to the Congo. It extends, however, farther south-eastward than was indicated on the map published in 1918 (p. 63, fig. 48).

Katanga : Panda River and Kimilolo River, many ♀ and ♂ (Mich. Bequaert).

Southern Rhodesia : Salisbury, 1 ♀, April 1913, S.A. Mus.

Eumenes maxillosus var. *fenestralis*, H. de Saussure.

Eumenes fenestralis, H. de Saussure, Et. Fam. Vesp., i, 1852, p. 53, pl. x, fig. 6 (♀♂).

Eumenes maxillosus var. *fenestralis*, A. v. Schulthess, Societas Entomol., xxv, 1910, p. 17. J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 59, 68, and 280 (♀♂).

Eumenes fenestratus, Radoszkowsky, Jorn. Sc. Math. Phys. Nat. Ac. Lisboa, viii, No. 31, 1881, p. 203.

Eumenes variventris, P. Cameron, Wiss. Ergebn. Schwed. Zool. Exp. Kilimandjaro, ii, 8, 6, 1910, pp. 175 and 180 (♂).

This interesting colour phase appears to be quite widely distributed over the African continent. It is known from the Senegal and Abyssinia to Angola and Natal.

Portuguese East Africa: Umbeluzi, 1 ♂, May 25, 1909 (C. W. Howard), U.S. Nat. Mus.

Natal: Mfongosi, 1 ♀ and 1 ♂, February and March, 1917 (W. E. Jones), S.A. Mus.

The South African specimens are coloured exactly like those I have seen from the Congo. Moreover, Gribodo has previously recorded *fenestralis* from Lourenco Marques and even from Port Elizabeth.

Eumenes alluaudi, J. Pérez.

Eumenes alluaudi, J. Pérez, Ann. Soc. Ent. France, lxiv, 1895, p. 206 (♀♂). J. Bequaert, Psyche, xxviii, 1921, p. 160, figs. 1*a*-1*d* (♀♂).

Eumenes lepeleterii var. *alluaudi*, J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 77 and 277.

This species does not occur on the African continent, being restricted to the Seychelles and the Glorioso Islands. At one time I believed that it was a colour phase of *E. lepeleterii*, but a study of specimens has shown that it is morphologically quite distinct, and rather allied to *E. maxillosus*.

It may be regarded as derived through oceanic isolation from *E. maxillosus*. A parallel case is afforded by *Eumenes germaini*, Lucas (Bull. Soc. Ent. France, 1875, p. 76; Ann. Soc. Ent. France, (5), vi, 1876, p. 300), of New Caledonia and the Loyalty Islands. *E. germaini* has sometimes been regarded as a synonym of *E. xanthurus*, de Saussure (which is but one of the colour phases of *E. maxillosus*); but on morphological grounds it is a distinct species, as shown by a series of specimens at the British Museum. The shape of the first abdominal segment is quite different from that of *E. maxillosus*: seen from above it is distinctly divided into a slender, basal half and a swollen, apical half about three times as wide as the base; slightly beyond the middle the first tergite bears on each side a very prominent, curved, spiracular tooth. The head is conspicuously thickened, the vertex being swollen and longitudinally furrowed behind; in both sexes the posterior ocelli are farther from the hind margin of the vertex than from each other. In the male the clypeus has a most extraordinary shape, which may be regarded as an exaggeration of that of *E. alluaudi*: the anterior portion is produced into a long, hatchet-like plate, the thin, median margin being slightly and concavely arcuate, while the projecting and divergent sharp edges are strengthened by a longi-

tudinal ridge. The antennal hook of the male is similar to that of *E. alluaudi.*

It is of interest that in both cases these precinctive species of *Eumenes* replace what apparently is their ancestral form. For, although colour phases of *E. maxillosus* are common in Madagascar and the Comoros, none have been collected in the Seychelles and Glorioso Islands; they are likewise absent from New Caledonia and the Loyalty Islands, while still occurring in the New Hebrides.

Eumenes macrocephala, H. de Saussure.

(Text-figure 14, *A–G.*)

Eumenes macrocephala, H. de Saussure, Et. Fam. Vesp., i, 1852, p. 37 (♂).

The following is a translation of the original description :—

" Black, ornamented with yellow.

" Male.—Length : 18 mm. ; spread of wing : 32 mm.

" Female unknown.

" Male.—A thickset insect. Head black, thick, so that the eyes do not entirely cover the sides. Clypeus straightly truncate at the anterior margin, yellow and slightly silvery. Mandibles, an incomplete margin of the orbits, a triangular spot on the front, and a spot on each side of the mandibles below the head, yellow. Antennae yellow on the under side, black on the upper side. Thorax black; prothorax yellow, with black posterior corners; between these corners and the tegulae there is an arcuate ferruginous line. Tegulae, two spots on the corners of the scutellum, and postscutellum yellow, as is also a large spot on each side of the metathorax. Head and thorax granulate, covered with russet pile. Petiole strongly campanulate, without any spine, black, ending in an irregular, yellow fascia; its swollen portion longitudinally furrowed. Second abdominal segment oval, black, margined with a broad yellow fascia somewhat notched in the middle, and marked on the sides with two elongate spots that almost join on the middle line; third segment yellow with a black base; the succeeding segments black with a rather indistinct, ferruginous marginal line. Under side of the abdomen black, the second segment ornamented with three yellow spots that almost touch, the succeeding segments with a broad, longitudinal, yellow band. Legs yellow; coxae and basal half of femora black, with a yellow dot on each coxa. Wings hyaline, slightly ferruginous; a brown tinge in the radial cell.

" Relationship and differences.—Very close to *E. amedei*. It differs from that species in the clypeus being straightly truncate and not rounded off, etc.

" Inhabits the Cape of Good Hope (Jurine Collection at the Museum of Geneva)."

A. v. Schulthess (Societas Entomol., xxv, 1910, p. 24), who examined the type, states that *E. macrocephala* cannot be distinguished from the Palaearctic *E. arbustorum* (Panzer). He suggests that the country of origin given by de Saussure might have been due to an error. I have, however, received from the South African Museum a male which agrees perfectly with de Saussure's description of *macrocephala*, and I have little doubt that it represents that species. The specimen is labelled Potchefstroom, Transvaal (T. Ayres), and there is no reason to assume that this is due to an error, as the South African Museum possesses no Palaearctic wasps. A detailed description of this specimen follows.

Male.—Head seen in front but little broader than high. Clypeus much longer than wide, elongate hexagonal, but little convex and slightly depressed before the apex ; the anterior, free portion about as long as the upper, interocular part ; the apical margin a little over one-third, but less than one-half, the total width of the clypeus, straightly truncate, with distinct but bluntly rounded edges. Vertex without fovea. Ocelli placed in a flattened triangle ; the posterior ocelli a little farther apart than from the inner orbits, about as far apart as from the hind margin of the vertex ; anterior ocellus larger. Front much raised and distinctly, though bluntly, carinate between the antennae. Eyes bare, about one and one-half times as far apart on the vertex as at the clypeus. Vertex and temples quite well developed, as in *E. arbustorum*, margined behind with a continuous, sharp rim. Mandibles very long and slender, decussate, straight, not curved at apex, with three superficial notches along the inner margin. Antennae moderately elongate ; the flagellum almost uniformly thick over its entire length ; antennal segments—4 to 6 distinctly and 7 slightly longer than broad, 8 square, 9 to 12 very little broader than long ; terminal hook long, robust and strongly curved, the blunt apex lying in a deep pit at the under side in the centre of the tenth antennal segment ; in profile the hook is finger-shaped, being rather rapidly narrowed beyond the base ; but seen from the upper side it is lengthened spatulate and bluntly ridged in the middle over the entire dorsal length. Thorax elongate oval, quite convex dorsally, about one and one-half times as long as high in profile, and one-third

longer than wide seen from above. Pronotum squarely truncate; the anterior margin rimmed throughout with a distinct raised line, which is but little more pronounced on the sides, below the humeral angles. Humeral angles quite distinct, but blunt. Mesonotum about as long as wide, with a fine, median, impressed line over its anterior half. Scutellum slightly convex, very gently sloping posteriorly, with a distinct, median, longitudinal line almost forming a furrow pos-

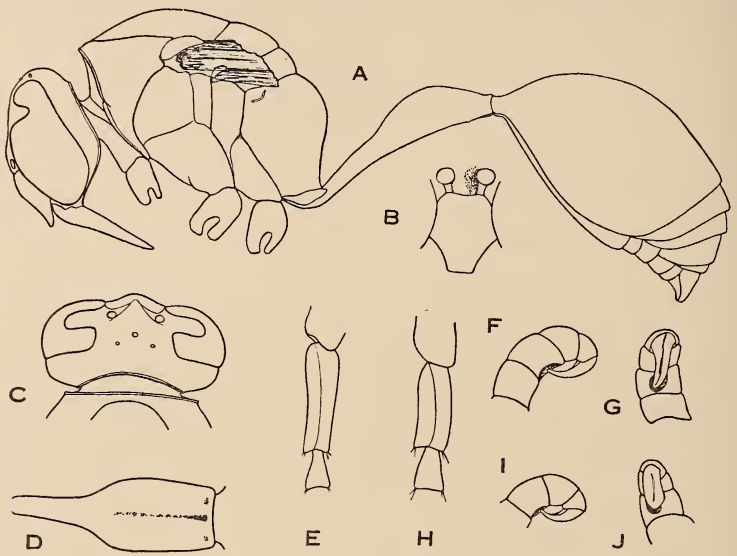

Fig. 14.—*A–G*, *Eumenes macrocephala*, H. de Saussure. *A*, male in profile; *B*, clypeus of male; *C*, head of male from above; *D*, first tergite of male from above; *E*, two basal segments of middle tarsi of male from above; *F*, terminal segments of male antenna in profile; *G*, terminal segments of male antenna from below. *H–J*, *Eumenes arbustorum* (Panzer). *H*, two basal segments of middle tarsi of male; *I*, terminal segments of male antenna in profile; *J*, terminal segments of male antenna from below.

teriorly. Postscutellum almost flat, somewhat depressed posteriorly, entirely within the posterior slope of the thorax, without any trace of median line. Propodeum moderately developed, seen from above about as long as the scutellum, quite convex, completely rounded off, without ridges or projecting angles on the sides, quite deeply grooved in the middle over its whole length; just above the base of the abdomen the sides of the channel are much raised and form a blunt angle, which is separated by a narrow notch from the valvulae. Mesopleura without carinae or ridges along the epicnemial depressions, which are but slightly marked for the fore and middle legs. Legs more slender than in *E. arbustorum*: the hind tibiae are rather more abruptly widened

in the apical half than in that species, being more slender at the base ; the tarsi are also thinner, the difference being quite well marked in the middle and hind tarsi ; the basitarsus of the middle legs, although more slender than in *E. arbustorum*, has the same characteristic shape : it forms an elongate prism, with a flattened under surface, the upper surface divided by a blunt ridge into an anterior bare and a posterior densely hairy face * ; the hairs are short, stiff, and somewhat silky, and form a conspicuous brush ; this brush is present in other *Eumenes* too, but in both *arbustorum* and *macrocephala* it is quite conspicuous on account of the unusual shortening of the basitarsus. Venation of wings of the usual *Eumenes* type, differing but little from that of *E. arbustorum* and *E. caffer*. First abdominal segment moderately long, elongate campanulate, more slender than in *E. arbustorum* ; nearly as long as the thorax in profile ; a little over three times as long as its greatest width seen from above ; nearly straight along the ventral line in profile ; rather suddenly swollen in its apical half, which is but little more than twice as thick as the base, regularly convex and gently sloping toward the apex ; in profile it is considerably less swollen than in *E. arbustorum*, though of the same general shape ; seen from above the basal half forms a slender petiole, which widens abruptly into the swollen apical half ; this swollen portion is over twice as wide as the basal stalk, fairly parallel-sided, though not with straight margins, much more elongate than in *E. arbustorum*, nearly twice as long as its greatest width, dorsally with a longitudinal groove, which becomes quite deep before the apex ; the spiracles form very low but distinct protuberances on the sides near the base of the swollen part, but they are not visible from above. Second segment elongate oval and slightly depressed, about equally convex dorsally and ventrally, about one and one-half times as long as high in profile and one and one-half times as long as wide seen from above ; basal neck short, but quite distinct, conspicuously narrower than the apex of the first tergite ; apical margin simple, depressed ; sternite flattened at base. Last (seventh) sternite straightly truncate at apex, with broadly rounded edges, the apical margin slightly raised in the middle ; its surface conspicuously concave, forming a broad, somewhat triangular cavity, which narrows toward the base of the sternite, where it is more like a channel between two converging, blunt ridges ; the concave area is finely granulate and covered with short hairs, which are somewhat longer toward the apex.

* This peculiarity of *E. arbustorum* is correctly described by F. Morawitz, Horae Soc. Ent. Rossicae, xxix, 1895, p. 419.

Puncturation very dense, but moderately coarse on head and thorax, somewhat larger on the vertex; clypeus with very few and quite widely scattered, minute punctures, practically impunctate, dull; on the temples (behind the eyes) the punctures are very fine and remote; the median channel of the propodeum shows a series of transverse striae, especially well marked in the lower half; tegulae with few, irregular punctures toward the margins, nearly impunctate in the centre. First abdominal tergite smooth and impunctate in its basal two-thirds; the apical third with remote, medium-sized punctures, much smaller than those of the thorax, and fairly uniformly scattered over the entire width. The remainder of the abdomen impunctate, except for a few minute punctures on the basal neck of the second tergite. Head and thorax with moderately long, greyish pile; the clypeus somewhat silvery; abdomen and legs almost bare.

Black, with conspicuous and abundant bright yellow markings as follows: clypeus; mandibles (passing into ferruginous in the apical half); scape of antennae (except for a broad, black streak over the upper surface); front between the antennae; inner orbits from the clypeus to half-way in the ocular sinus; a broad line along the outer orbits in the upper half of the temples; pronotum entirely; upper plate of mesopleura entirely and continuous with a very large spot on the lower plate; posterior half of tegulae; a broad, transverse band on the scutellum; postscutellum entirely; propodeum (except for a wide, median stripe in the longitudinal channel); an elongate, dorsal spot on each side near the base of the swollen part of first tergite; two much larger spots at apex of first tergite, narrowly connected medially and produced anteriorly on the sides; second tergite, except for a broad black mark in the shape of an inverted T, the base of which widens over the basal neck, while the arms form a transverse band about the middle (the yellow covering about the apical third of the tergite and somewhat angularly notched with black medially); second sternite (except for the basal black third and a small black spot on each side shortly before the apex); third to sixth sternites and tergites, except at base; a transverse fascia over the middle of the seventh tergite; large spots on the fore and middle coxae; the major part of the fore and middle femora; the tibiae and much of the tarsi. The basal half of the flagellum and the hind femora are bright ferruginous-red; while the upper side of the fore and middle femora is extensively ferruginous and the apex of the tibiae and tarsi also shows a ferruginous tinge. Wings sub-

hyaline, somewhat suffused with amber-yellow anteriorly, especially in the subcostal cell; the radial cell more infuscated and somewhat purplish.

Length (h.+th.+t. 1+2) : 14 mm.

A comparison with males of typical *E. arbustorum* (Panzer), of the Pyrenees, France, discloses several differences in structure, some of which may be pointed out:

(*a*) The clypeus is much longer than wide and straightly truncate at the apex. In *arbustorum*, it is relatively shorter and quite evenly, arcuately rounded off.

(*b*) The flagellum is shorter and thicker throughout; its terminal hook rather narrow and bluntly ridged over the whole length. In *arbustorum*, it is more elongate, almost all the antennal segments (except the eleventh and twelfth) being longer than wide; the terminal hook broadly spatulate, with a short dorsal crest (fig. 14, *I–J*).

(*c*) The thorax is much less swollen. In *arbustorum*, it is but little more than one-fourth longer than high.

(*d*) The propodeum is more convex on the sides, the median channel being much deeper. In *arbustorum*, the channel is more broadly open and its sides do not form blunt angles above the valvulae.

(*e*) The legs are more slender, which is especially conspicuous for the tarsi and the hind tibiae. In *macrocephala*, the middle basitarsus is over twice the length of the second tarsal segment and about three times as long as wide. In *arbustorum*, the hind tibiae are short and thick, gradually widening from base to apex; the middle basitarsus is about twice the length of the second tarsal segment and between two and three times as long as wide (fig. 14, *H*).

(*f*) The first abdominal segment is shaped quite differently. In *arbustorum*, it is distinctly shorter than the thorax; the apical half much more swollen, nearly three times as thick as the basal stalk in profile, and seen from above but little longer than wide; it is also much more densely and coarsely punctured than in the male here described as *macrocephala*.

(*g*) The last sternite in *E. arbustorum* is more shallowly and uniformly depressed.

With regard to coloration the resemblance with *E. arbustorum* var. *amedei*, Lepeletier de St. Fargeau, of Algeria, is quite remarkable. To judge from de Saussure's description and figure, *E. sichelii*, de Saussure (Et. Fam. Vesp., i, 1852, p. 36, pl. x, fig. 2), of Albania, is still more like it; in addition, *sichelii* is said to have the clypeus straightly truncate at apex, so that it might be even more closely

allied to *macrocephala* than *arbustorum*. Unfortunately I have no specimens of *sichelii* for comparison.

Although the structural characters are quite sufficient to regard *arbustorum* and *macrocephala* as specifically distinct—the differences between some other species of *Eumenes*, such as the Nearctic *E. fraternus*, Say, *E. verticalis*, Say, and *E. globulosus*, de Saussure, are much more obscure—yet there can be little doubt that the two have been derived from some common ancestor. Nowadays the Palaearctic *E. arbustorum* (with several colour phases) does not extend southward beyond the Mediterranean subregion, being thus separated from *E. macrocephala* by the entire tropics.

If one relies upon the colour alone, *E. macrocephala* and *E. caffer* might easily be confused, and it is probably for this reason that *macrocephala* has been thus far overlooked. The black marking of the second tergite, however, does not form a complete cross as in *caffer*. Structurally the two are not in the least related.

Doubtful Species.

Eumenes higletti, G. Meade Waldo.

Eumenes higletti, G. Meade Waldo, Ann. Mag. Nat. Hist., (8), v, 1910, p. 43 (♀).

"♀, black; clypeus, mark between antennae at base, a line behind them, pronotum almost reaching to tegulae, large ovate spot (interrupted in the centre) on mesopleura on each side, posterior margin of postscutellum, median segment broadly on each side, apical margin of the petiole on each side, apical margin of second abdominal segment, except medio-dorsally, and two small isolated spots, apical margins of segments 3, 4, 5 (interrupted dorsally and continuous ventrally), yellow. Anterior femora and tibiae on outside, base of intermediate and posterior tibiae, yellow. Antennae beneath, two quadrate spots on scutellum, tegulae, metapleura on each side, petiole medially, apical segment of abdomen, legs (except where yellow), ferruginous. Wings hyaline, tinted with a golden sheen toward costal area, radial cell fuscous. Clypeus broadly ovate, truncate at the apex, rather longer than broad; pronotum angular in front; median segment truncate, produced toward apex on each side to form a V-shaped depression; petiole rather longer than thorax, slender, the apical portion broader, a small tubercle on each side; following segments elongate ovate. Punctured: vertex and thorax finely and evenly;

mesonotum with a short longitudinal carina, not reaching the middle ; petiole and abdomen shining anteriorly, petiole very minutely and sparsely punctured. Vertex of head and median segment with a dense grey pubescence. Length, 17 mm. Hab., Tamsoo, Gold Coast (G. A. Higlett) ; 1 ♀."

Eumenes signicornis, F. Walker.

Eumenes signicornis, F. Walker, List of Hymenoptera collected by J. K. Lord in Egypt, 1871, p. 30 (no sex).

" Black, roughly punctured. Front yellow, slightly silvered ; a small yellow dot between the antennae ; a short yellow line along the hind side of each eye and a shorter yellow line along the outer side of each eye. Antennae reddish, with a piceous streak near the base and a piceous band near the tip. Thorax ; a band on the fore border straightened in the middle, tegulae, two short bands on the scutellum, two transverse streaks on each side, and a large spot on each side of the metathorax yellow. Legs reddish ; tibiae and four anterior femora yellow on the outer side. Wings cinereous ; veins black. Fore wings with a blackish streak along the apical part of the costa. Length of the body 5 ? lines." Massaua, Eritrea.

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